



UNITED STATES NAVY

Medical News Letter

Vol. 50

Friday, 21 July 1967

No. 2

Surgeons General of the Past

(The sixteenth in a series of brief biographies)



William Knickerbocker Van Reypen, the twelfth Surgeon General and sixteenth Chief of the Bureau of Medicine and Surgery, was born in New Jersey in 1840, and graduated from New York University Medical College in 1862 after he was appointed Assistant Surgeon in the Navy 25 December 1861. Following brief duty at the naval hospital in New York, he served on the steam frigate *St. Lawrence* in the East Gulf Blockading Squadron and was promoted to Passed Assistant Surgeon in May 1865 and to Surgeon in May 1868. His later assignments included duty with the European Squadron and Asiatic Station, and service at the naval hospitals in Chelsea, Mass., Norfolk, Va., Annapolis, Md., and New York. He was promoted to Medical Inspector in 1887 and Medical Director in 1893. Appointed Surgeon General of the Navy 23 October 1897 by President McKinley, he led the Medical Department during the Spanish American War and also under President Roosevelt until 25 January 1902. A hospital ship, the *Solace*, originally the steamer *Creole* of the Cromwell line, was fitted out in 16 days, and served the fleet well as a hospital in Cuban waters for the duration of the war. She was the first American naval vessel to fly the Red Cross flag and remained in commission until 1920. During his administration a separate Hospital Corps and increased rank for medical officers were achieved by legislation. In 1899 the Surgeon General was given the rank of Rear Admiral though the pay and allowances were still those of a Commodore. Admiral Van Reypen's administration saw the commissioning of naval hospitals at Newport, R.I., 1897; Sitka, Alaska, 1898; Port Royal, S.C., 1898; and Cavite, P.I., 1898. Some of his accomplishments represented the fruition of measures initiated or strongly urged previously by Surgeon General Tryon. After retirement, Admiral Van Reypen lived in Washington, where he died in 1920.

United States Navy
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The issuance of this publication approved by the Secretary of the Navy on 4 May 1964.

THE SURGERY OF PATENT DUCTUS ARTERIOSUS

A CLINICAL REPORT OF 14 YEARS' EXPERIENCE WITHOUT AN OPERATIVE DEATH

Benson R. Wilcox MD and Richard M. Peters MD, *Ann Thorac Surg* 3(2):126-131, February 1967.

Opinions differ as to the best way operatively to close a patent ductus arteriosus. Scott has described suture ligation as an acceptable means of interrupting ductal flow. However, Jones, in a recent review of his 25 years' experience with this lesion, stated "... in all cases of patent ductus arteriosus the ductus should be divided and not ligated."

Since the North Carolina Memorial Hospital has been open, 123 patients with patent ductus arteriosus as their only cardiac lesion have had surgery. In 85 of these patients, the ductus was ligated, and in 37, the ductus was divided. In 1 patient ductal flow was not interrupted due to increased pulmonary vascular resistance and a right-to-left shunt; therefore, this patient will not be included in the statistics presented below.

The purpose of this paper is to describe the rationale behind varying our operative approach and to report our results using both techniques.

Patient Material

Age and Sex. The 122 patients in this series represent all clinic and private patients operated on at North Carolina Memorial Hospital for patent ductus arteriosus unassociated with other cardiac lesions. Thirteen house officers and attending surgeons performed the operations reported here. Females predominated in a ratio of 2.6:1, and no racial preponderance was observed. The ages ranged from two months to 53 years. Over one-half of the patients were age 5 years or younger, and 8 of these were less than six months of age. Five of these 8 were in poorly controlled cardiac failure, and the remaining 3 could not be cared for without benefit of surgery

because of their extremely poor home environment. Three of the 4 patients over 30 years of age were essentially asymptomatic; however, the oldest patient, age 53, was in cardiac failure with cardiomegaly and marked pulmonary hypertension (110/60 with a mean of 70 mm. Hg).

Pressure Data. The hemodynamic spectrum of this series is reflected in an unselected series of 26 consecutive patients in whom pulmonary artery pressures were measured. Figure 2 indicates the mean pulmonary artery pressures in these patients obtained before and after occlusion of the ductus at the time of surgery. Eleven of these patients had a preoperative pulmonary artery mean pressure in the range of 30 mm. Hg or higher. Particularly pertinent to this study is the observation that all 11 of these patients had ductuses at least one-half the size of the aorta. Conversely, no patients with ductuses less than one-half the size of the aorta had a mean pulmonary artery pressure of greater than 25 mm. Hg. These data, in addition to other considerations men-

MEAN PULMONARY ARTERY PRESSURE
BEFORE AND AFTER OCCLUSION

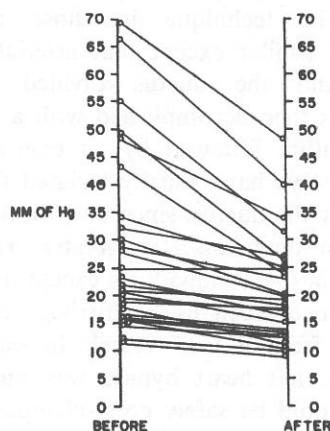


FIG. 2. Change in mean pulmonary artery pressure measured in 26 consecutive patients undergoing operative closure of their patent ductuses.

From the Division of Thoracic and Cardiovascular Surgery, University of North Carolina School of Medicine, Chapel Hill, N. C. Presented at the Thirteenth Annual Meeting of the Southern Thoracic Surgical Association, Asheville, N. C., Nov. 3-5, 1966.

tioned below, contributed to the rationale governing our approach to the operative closure of patent ductuses.

Pathogenesis. A history of maternal rubella was encountered less than might be expected in patients with congenital heart disease. This is probably a reflection of the fact that this study was limited to those patients with patent ductus as the only cardiac lesion. Indeed, there were no patients with an unequivocal history of maternal rubella, though 2 individuals had ophthalmological difficulties and 1 had multiple congenital anomalies outside the cardiovascular system. Eight patients reportedly were born prematurely; 1 of these and 1 additional patient suffered some form of fetal distress as reported by their parents. In our series, the diagnosis of patent ductus arteriosus has been confirmed in the following family combinations. (1) mother and two daughters, (2) mother and daughter, (3) brother and sister, and (4) sister and sister. This familial incidence of 7.3 percent is somewhat higher than in previously reported series.

Operative Procedure

The ductus is exposed through a lateral thoracotomy in the third interspace in infants and children and in the fourth interspace in adults. Regardless of whether we plan ligation or division, narrow tapes are passed around the ductus so that the recurrent laryngeal nerve can be readily visualized. A purse-string suture is placed in the external wall and adventitia at each end of the ductus. After the aortic and pulmonary artery purse-string sutures are securely tied, in that order, the central lumen of the ductus is aspirated with a 25-gauge needle. A third suture ligature is then placed at the midpoint of the ductus. The technique in those requiring division is very similar except that arterial clamps are applied and the ductus divided between them. Closure is then accomplished with a continuous mattress suture followed by an over-and-over suture. In adults we have usually isolated the aorta above and below the ductus, since the risk of tearing the more friable adult vessels is greater. The aorta is not occluded in these individuals except under unusual circumstances such as hemorrhage or threat of hemorrhage from a torn vessel. In our oldest patient, age 53, left heart bypass was utilized so that the aorta could be safely cross-clamped during division of his arteriosclerotic ductus.

Selection of Operative Procedure. Division of the ductus is generally preferred where the ductus is

large (one-half the size of the aorta, or greater than 6 mm. in diameter), since these vessels are more likely to tear if ligation is attempted. In addition, as our pressure data indicate, these larger ductuses are apt to be associated with pulmonary hypertension. It is our experience in patients with pulmonary hypertension that the pulmonary artery side of the ductus is more liable to leak if suture ligation is carried out. Therefore, individuals with pulmonary arterial mean pressure greater than 30 mm. Hg require division of the ductus and careful suture closure. All other patients not having a large ductus or persistent pulmonary hypertension have their ductuses ligated.

Results

Generally one accepts an operative procedure on its ability to accomplish the desired goals with a certain specific degree of safety. Since there has been no mortality in this series and none of the patients has experienced a disabling complication, we must look to subtler indications of the safety of this approach and the major operative complications associated with either ligation or division of the ductus. There were no instances of cardiac arrest. Major intraoperative hemorrhage was associated with a tear of the ductus in 1 patient in whom ligation was being attempted. The other major hemorrhage occurred when the aorta tore during placement of the arterial clamps prior to division of the ductus. Four other patients had a tear in one of the major vessels (aorta, ductus, or pulmonary artery), but these did not result in major hemorrhage though it was necessary to cross-clamp the aorta in all these patients. Neither massive transfusion nor other complications resulted; however, since we do not routinely cross-clamp the aorta, this was included as a complication. Of the 4 patients with vessel tears unassociated with hemorrhage, 3 had ligation and 1 had his ductus divided.

There were no cases of paraplegia and only 1 wound infection. The major complications seen in the ligation group postoperatively included 1 case of recurrent nerve paralysis, 1 of chylothorax, and 1 patient who required reexploration for intercostal vessel bleeding. Of those undergoing division, there was 1 patient who had significant postoperative bleeding; however, reexploration was not required. This was the patient in whom partial bypass had been used requiring heparinization. After his clotting abnormalities had been overcome, further transfusion was not necessary. There were no cases

of chylothorax or recurrent nerve injury in the 37 patients in whom the ductus was divided.

Evidence of Recanalization. All but 8 of the patients have been followed for at least six months postoperatively. There are no cases suspected of recanalization. Short of catheterization, the pertinent findings indicative of operative success were judged to be the absence of murmurs, lack of radiological or electrocardiographic evidence of left ventricular hypertrophy, and the absence of abnormal pulmonary vascular markings.

Murmurs. All patients had some notation of the presence or absence of murmurs in the postoperative period. Of these patients, 94 percent (114 of 122) were examined in our clinic at least at six months following surgery. No patient had a murmur typical of patent ductus arteriosus. Eleven of the 85 patients (12 percent) with ligation and 7 of the 37 (19 percent) having division of their ductus had a grade 1/6 systolic murmur. Five patients had a grade 2 or 3 systolic murmur; 4 of these had ligation, and 1 had division. None of the 23 patients with murmurs had electrocardiographic or radiological evidence of persistent ductus flow.

Electrocardiograms and X-rays. Only those patients who had comparable chest films and/or electrocardiograms made at least one year following surgery are included in this comparison. This limitation is imposed to insure adequate time for postoperative changes to have taken place. Table 1 lists the findings noted at the time of postoperative evaluation. The rarity of persistent left ventricular hypertrophy or increased pulmonary vascular markings is striking. Also noteworthy is the fact that even in those individuals with persistent postoperative abnormalities, there is no preponderance in either the

ligation or division group. Thus, there is no evidence to suggest recanalization or persistent patent ductus arteriosus in any of these patients.

Discussion

In view of our experience with the treatment of patent ductus arteriosus, we do not feel it is necessary or desirable to limit our attack on this problem to a single operative procedure. It is generally safer to divide large ductuses because of the risk of tearing the vessel with ligation. Also, in older individuals or those persons with pulmonary hypertension, the danger of a friable vessel wall makes ligation unduly hazardous. Conversely, the small, soft ductus with minimal anatomical and physiological alteration is more safely treated by ligation. These assertions are supported by the lack of mortality or disabling morbidity in this series of 122 consecutive operations interrupting patent ductus flow.

In addition to the consideration of safety, one must determine the effectiveness of our approach. Although cardiac catheterization would be the ideal method of determining postoperative results, other means of evaluating the patient are adequate unless strong suspicion of recanalization exists. Review of physical, electrocardiographic and radiographical findings in these patients demonstrate no evidence suggestive of persistent or recurrent aortic-pulmonary artery shunting. Consequently, the method of operative selection described in this study would seem to be an effective means of treating the patient with patent ductus arteriosus.

Summary

A review of the total experience with patent ductus arteriosus at the North Carolina Memorial Hos-

TABLE I. FOLLOW-UP DATA ON 122 PATIENTS HAVING CORRECTIVE SURGERY FOR PATENT DUCTUS ARTERIOSUS

| | Preoperative | Postoperative | Ductus Arteriosus | |
|---|--------------|----------------------|-------------------|---------|
| | | | Ligated | Divided |
| ECG evidence of left ventricular hypertrophy | 65 of 122 | 4 of 28 ^a | 2 | 2 |
| X-ray evidence of left ventricular hypertrophy | 59 of 122 | 2 of 37 ^a | 1 | 1 |
| X-ray evidence of increased pulmonary vascular markings | 95 of 122 | 2 of 56 ^a | 1 | 1 |

^a Number of patients with comparable studies done more than 1 year postoperatively.

pital has been presented. The case material, operative approach, as well as complications and results of operation have been described. Approximately 30 percent of these patients had their ductus transected and sutured because of the large size of the vessel and degree of pulmonary artery hypertension. The remaining 70 percent were treated by triple ligation of the ductus. There were no operative deaths or disabling complications, nor was there evidence to suggest persistent or recurrent ductal flow in any of the patients. It is concluded that no single operation

is best in the treatment of patent ductus arteriosus. Rather, one must consider the individual case and apply that operation best suited to the anatomical and hemodynamic abnormalities of each patient.

(See article, Severe Pulmonary Hypertension Accompanying Patent Ductus Arteriosus, by S. Berlind, et al, *American Heart Journal* 73:460-467, April 1967—Editor.)

(The omitted figures and references may be seen in the original article.)

CLINICAL PRESENTATION OF RUPTURED INTRACRANIAL ANEURYSM

Martin Sarner and F. Clifford Rose, From Atkinson Morley's (St. George's) Hospital, London. J Neurol Neurosurg Psychiatr 30(1):67-70, February 1967.

In a recent study, ruptured intracranial aneurysm was found in 28 percent of all cerebrovascular deaths under the age of 60 (Crawford and Sarner, 1965), and angiography reveals it as the cause of approximately 60 percent of all cases of subarachnoid haemorrhage (McKissock, Paine, and Walsh, 1958). Although the overall mortality from ruptured intracranial aneurysm remains in the region of 50 percent, it has been shown that this can be lowered by surgical intervention, depending on the site of the aneurysm (McKissock, Richardson, and Walsh, 1960, 1962, 1965). If the presence and site of an aneurysm could be diagnosed by the clinical presentation, the management of subarachnoid haemorrhage might be made more definitive. We have therefore studied the gross presenting clinical features in a large number of cases of subarachnoid haemor-

rhage in which a single intracranial aneurysm was subsequently revealed by arteriography or necropsy.

Case Material

The records of all cases of subarachnoid haemorrhage caused by proved ruptured intracranial aneurysm were analyzed in respect of the recorded history and the physical signs present on the patients' admission to Atkinson Morley's Hospital, London, during the five-year period, 1958 to 1962. Cases of multiple aneurysms were excluded from this study and there were 962 cases in all.

Results

Table I shows the clinical material analysed as to sex and site. The 'anterior' group includes aneurysms arising from the anterior cerebral-anterior

TABLE I
962 CASES OF PROVED RUPTURED INTRACRANIAL ANEURYSMS 1958-1962

| Sex | Group ¹ | | | |
|--------|--------------------|--------|-----------|------------------|
| | Anterior | Middle | Posterior | Vertebro-basilar |
| Men | 182 | 91 | 97 | 16 |
| Women | 199 | 162 | 195 | 20 |
| Totals | 381 | 253 | 292 | 36 |

¹Anterior = anterior cerebral-anterior communicating artery complex

Middle = middle cerebral artery

Posterior = posterior communicating-posterior cerebral artery complex

Vertebro-

basilar = vertebral and basilar arteries and their branches

communicating artery complex, the 'middle' group indicates those arising from the middle cerebral artery, and the 'posterior' group includes those arising from the posterior communicating-posterior cerebral artery complex. The vertebro-basilar group includes aneurysms arising from the vertebral and basilar arteries and their branches. The percentage of aneurysms occurring in the various sites is in accordance with previous reports (McDonald and Korb, 1939; Bull, 1962), the anterior group forming a slightly higher percentage than the middle or posterior groups and the vertebro-basilar group being by far the smallest. The sex incidence is equal in the anterior group but middle and posterior aneurysms are twice as common in females. This accords with the suggestion that males with ruptured cerebral aneurysms may not survive long enough to be transferred for neurosurgical investigation (Crawford and Sarnar, 1965).

Symptoms

Headache. Table II shows the relationship between the site of aneurysm and the presence and localization of headache. The most striking finding is that only 21 percent of cases were recorded as having the classical occipital headache once considered typical of subarachnoid haemorrhage. In 15 percent the

headache was frontal or retro-ocular and in 32 percent it was not localized at all. Twenty-three percent (232 cases) were not recorded as having had a headache but this was usually because the patients presented in coma (116 cases) or were too drowsy to give a history. In only 77 cases (8 percent) was the headache on one side and, although this was an accurate symptom in lateralizing the aneurysm in two-thirds of these cases, it was of no value in discriminating between anterior, middle, or posterior aneurysms.

Disturbance of Consciousness. From Table III it can be seen that half the patients had been in coma at some time and this was irrespective of the site of the aneurysm. Confusion, as evidenced by inability to give a coherent history, was recorded in a higher percentage of the middle group but this may reflect the difficulty in distinguishing this from dysphasia, a common finding when the aneurysm arises from the middle cerebral artery of the dominant side.

Fits at Onset. Fits at the onset of subarachnoid haemorrhage were more frequent in the anterior and middle groups and less so in the posterior group (Table III); this is to be expected as the fronto-parietal areas are the most epileptogenic (Rose and Sarnar, 1965).

TABLE II
SITE OF HEADACHE

| | <i>Site of Headache</i> | | | | |
|-----------------------|-------------------------|---------------|------------------|-------------------------|------------------|
| | <i>Anterior</i> | <i>Middle</i> | <i>Posterior</i> | <i>Vertebro-basilar</i> | <i>All Sites</i> |
| Total number of cases | 381 | 253 | 292 | 36 | 962 |
| Occipital (%) | 24 | 20 | 19 | 39 | 21 |
| Frontal (%) | 14 | 15 | 19 | 3 | 15 |
| Temporal (%) | 3 | 9 | 13 | 6 | 8 |
| Not localized (%) | 35 | 28 | 29 | 30 | 32 |
| None (%) | 24 | 28 | 20 | 22 | 24 |

TABLE III
DISTURBANCE OF CONSCIOUSNESS AND OTHER SYMPTOMS

| | <i>Anterior</i> | <i>Middle</i> | <i>Posterior</i> | <i>Vertebro-basilar</i> | <i>All Sites</i> |
|--------------------------------|-----------------|---------------|------------------|-------------------------|------------------|
| Total number | 381 | 253 | 292 | 36 | 962 |
| Coma (%) | 52 | 53 | 51 | 49 | 52 |
| Confusion (%) | 11 | 16 | 10 | 22 | 12 |
| Fits at onset (%) | 10 | 9 | 4 | 14 | 8 |
| Nausea or vomiting (%) | 55 | 38 | 39 | 40 | 45 |
| Paraesthesiae and numbness (%) | 3 | 5 | 3 | nil | 4 |

Nausea or Vomiting. These were more frequent in the anterior than in the middle or posterior groups (Table III).

Paraesthesiae and Numbness. These were rare symptoms but were slightly more frequent in the middle group, as would be expected in cases where there is likely to be ischaemia of the post-central areas. These symptoms were not recorded at all in the vertebro-basilar group but no firm conclusion can be drawn because of the relatively small number of cases.

Other Symptoms. Backache, photophobia, double vision, and shoulder pain were some of the other symptoms recorded but there was no association between any of these and the site of the aneurysm.

Precipitating Factors. Fifty cases were recorded as having occurred at the time of physical effort, *e.g.*, cranking a car or running. A further 17 patients bled while straining at stool or sneezing, 20 while bending down, and six patients, one of whom was a woman, developed haemorrhage during sexual intercourse.

State of Consciousness. As noted previously, the state of consciousness, either at the onset of the bleeding on admission to hospital, was no guide to the site of the aneurysm (Table IV).

Meningism. As evidence by neck stiffness, meningism was recorded as present in 622 cases at the time of admission to Atkinson Morley's Hospital (Table IV). Of these, 282 were drowsy and 53 were in coma. There was no reference to meningism in 340 cases; this may be explained partly on the basis of a disturbance of consciousness (drowsy 70 cases, coma 63 cases), but the majority of this group had completed a period of bed rest at another hospital before referral.

Ophthalmological Signs. These are set out in Table V.

Unequal pupils were found in 112 cases (11 percent) most of these being in the posterior group.

A third nerve palsy, either partial or complete, occurred in 66 cases, the vast majority being in the posterior group.

Intra-ocular haemorrhages, either vitreous, subhyaloid or preretinal, occurred in 121 cases and were seen less frequently in the posterior group.

Papilloedema occurred in 90 cases, being less common in the posterior group, possibly due to the lower incidence of intracerebral haematoma here.

Cerebral Hemisphere Signs. Table VI summarizes the incidence of these signs.

Dysphasia and aphasia were noted in 124 cases

TABLE IV
STATE OF CONSCIOUSNESS AND PRESENCE OF MENINGISM ON
ADMISSION

| | <i>Anterior</i> | <i>Middle</i> | <i>Posterior</i> | <i>Vertebro-basilar</i> | <i>All Sites</i> |
|----------------------------|-----------------|---------------|------------------|-------------------------|------------------|
| Total number | 381 | 253 | 292 | 36 | 962 |
| State of Consciousness (%) | | | | | |
| Alert | 50 | 50 | 54 | 50 | 50 |
| Drowsy | 37 | 37 | 37 | 30 | 36 |
| Comatose | 13 | 13 | 9 | 20 | 12 |
| Meningism (%) | 67 | 67 | 59 | 68 | 64 |

TABLE V
OPHTHALMOLOGICAL SIGNS

| | <i>Anterior</i> | <i>Middle</i> | <i>Posterior</i> | <i>Vertebro-basilar</i> | <i>All Sites</i> |
|-----------------------------|-----------------|---------------|------------------|-------------------------|------------------|
| Total number | 381 | 253 | 292 | 36 | 962 |
| Anisocoria (%) | 7 | 7 | 20 | 21 | 11 |
| Third nerve palsy (%) | 2 | 1 | 17 | 11 | 7 |
| Intraocular haemorrhage (%) | 13 | 15 | 9 | 21 | 12 |
| Papilloedema (%) | 11 | 11 | 6 | 6 | 9 |

TABLE VI
CEREBRAL HEMISPHERE SIGNS

| | <i>Anterior</i> | <i>Middle</i> | <i>Posterior</i> | <i>Vertebro-basilar</i> | <i>All Sites</i> |
|---------------------------|-----------------|---------------|------------------|-------------------------|------------------|
| Total number | 381 | 253 | 292 | 36 | 962 |
| Dysphasia (%) | 12 | 20 | 9 | 3 | 13 |
| Homonymous hemianopia (%) | 5 | 16 | 10 | 3 | 9 |
| Reflex changes (%) | 21 | 19 | 18 | 32 | 19 |
| Motor defects (%) | 13 | 27 | 17 | 9 | 17 |
| Sensory disturbances (%) | nil | 11 | 5 | 3 | 5 |

TABLE VII
NO LOCALIZING SIGNS

| | <i>Anterior</i> | <i>Middle</i> | <i>Posterior</i> | <i>Vertebro-basilar</i> | <i>All Sites</i> |
|--------------|-----------------|---------------|------------------|-------------------------|------------------|
| Total number | 381 | 253 | 292 | 36 | 962 |
| | (45%) | (30%) | (39%) | (42%) | (39%) |

and were twice as common in the middle as in the other groups.

Homonymous hemianopia was recorded in 91 cases; it was three times more common in the middle than in the anterior group, the posterior group being intermediate.

Reflex changes were as common in the anterior and posterior groups as in the middle group.

Motor defect, either monoplegia or hemiplegia, was, as expected, far more common in the middle group.

Sensory disturbances, including hemi-anaesthesia, hemi-hypaesthesia and tactile inattention, were uncommon. They were usually associated with motor defect and were again more common in the middle group.

No Localizing Signs. In 39 percent of all cases (378) there were no localizing signs, *i.e.*, neither cranial nerve palsy, visual field defect, nor motor or sensory changes in the limbs (Table VII). Although less surprising in the anterior group, where nearly one half of the cases had no localizing signs, this was also true of nearly one third of the middle group.

Discussion

The increasing diagnosis of ruptured intracranial aneurysm due to the more frequent use of arteriography has not been accompanied by a more precise delineation of related clinical syndromes. Earlier clinical studies concerned either the less common

unruptured aneurysm (Meadows, 1951) or subarachnoid haemorrhage in which the diagnosis was confirmed by arteriography in only a minority of cases (Walton, 1956). Only by a study of a large number of proven cases can the reliability of the classical textbook descriptions be assessed.

This retrospective survey suffers the usual limitations of case-note data and for this reason we have limited our study to gross clinical features only; it should also be borne in mind that the cases were a selected group in that they were suitable for investigation by reason of age and clinical state and, secondly, had survived long enough to be investigated. In spite of these limitations several interesting features are revealed.

Only 21 percent of cases presented with a history of classical occipital headache; more commonly the headache was generalized (one third of cases). In nearly a quarter there was no record of headache at all, but this may well have been due either to the presence of coma or to a retrograde amnesia. Lateralization of the headache occurred only rarely (less than 10 percent) and did not always indicate the site of the bleed, a point noted by others (Henderson, 1955; Frankel and Alpers, 1955; Walker, 1956; Dimsdale and Logue, 1959). Site of the headache was most unreliable as a guide to localization of the aneurysm, a ruptured posterior aneurysm being as likely to have a frontal as an occipital headache. Coma occurred in half the cases irrespective of the site of the aneurysm; this is contrary to the

usual belief that loss of consciousness is more common in aneurysms of the anterior cerebral or anterior communicating arteries, the branches of which supply the hypothalamus. Patients who had bled from an aneurysm in the posterior group were slightly more likely to regain consciousness by the time of admission.

A convulsive onset was also a poor guide to the site of the aneurysm as this occurred in all groups; fits were more common in the anterior and middle groups as would be expected from the greater incidence of intracerebral haematoma in these groups (Crompton, 1962), and the fact that the fronto-parietal regions are the most epileptogenic.

Nausea and vomiting occurred in less than half the cases, other symptoms such as sweating, photophobia, or limb pain due to nerve root irritations being rarely recorded. Symptoms referable to the limbs were also rare but slightly more common in the middle group. The transient weakness of limbs that has been reported in association with vertebro-basilar aneurysm (Dimsdale and Logue, 1959) was not recorded in this series.

The association of a third nerve palsy and an aneurysm on the terminal part of the internal carotid artery or the posterior communicating artery is well known (Meadows, 1951; Walker, 1956), and was confirmed by this series; however, it may occur with ruptured aneurysms at other sites, although much less commonly. Only a minority (17 percent) of cases of ruptured posterior aneurysms had evidence of an oculomotor palsy, but its presence was a helpful localizing sign. The earliest indication of compression of the third nerve is a dilated pupil, since the pupillo-constrictor (parasympathetic) fibres travel in this nerve peripherally on its supero-medial aspect and would be adjacent to a posteriorly situated aneurysm; a unilateral dilated pupil usually indicates the side of the bleed. Of the 11 percent of cases in which this was present (that is, a unilateral dilated pupil), the majority occurred in the posterior group, but the incidence of this physical sign was just as common in the vertebro-basilar group as in the posterior group; in the other groups the unilateral dilated pupil was presumably due to compression of the third nerve from tentorial herniation consequent upon intracerebral oedema or haematoma.

Papilloedema (9 percent) and intraocular haemorrhage (12 percent) occurred with aneurysms at all sites but each was slightly less frequent in the posterior group, possibly due to the lower incidence of intracerebral haematoma with this aneurysm (Crompton, 1962).

Visual field defects occurring in cases of subarachnoid haemorrhage may be difficult to assess because of lack of cooperation from the patient or the presence of intra-ocular haemorrhages. However, homonymous hemianopia was said to be present in 16 percent of the middle and 10 percent of the posterior group.

Signs relating to lesions of the cerebral hemispheres such as dysphasia, hemiparesis, or hemianaesthesia occurred more commonly in the middle group, as noted already (Frankel and Alpers, 1955; Walker, 1956); hyperreflexia alone appeared to be slightly more common in the anterior group.

Nearly 40 percent (378 cases) had no localizing neurological signs, and we feel that this is of great importance. Together with the other findings it indicates the uncertainty of clinical localization of a ruptured intracranial aneurysm. The site of an aneurysm determines its suitability for surgical treatment; the only certain way to establish this is by arteriography which should be carried out in every patient well enough to be investigated.

Summary

Nine hundred and sixty-two cases of proved ruptured intracranial aneurysm have been analysed with regard to their gross presenting clinical features; the distribution of cases was comparable with other large series.

Only a minority of cases presented with the classical picture of occipital headache; meningeal irritation was not recorded in one-third. Loss of consciousness occurred in approximately half the cases, irrespective of the site of aneurysm.

The most valuable localizing signs were unilateral mydriasis or oculomotor palsy indicating a posterior aneurysm and parietal lobe signs suggesting a middle group aneurysm; no single physical sign was pathognomonic of one aneurysm site.

The results of surgical treatment of ruptured intracranial aneurysm depend on its site; since this cannot be ascertained with certainty by clinical means, arteriography is mandatory.

We should like to thank Messrs. W. M. McKissock, L. S. Walsh, and A. E. Richardson for permission to study their patients. This work was carried out whilst one of us (M. S.) was in receipt of a grant from the National Institute of Health, Bethesda, U.S.A.

(The references may be seen in the original article.)

RECENT OBSERVATIONS ON CONCEPTS OF METASTASIS

An Editorial Reprinted from Arch Path 83(4):321-324, April 1967.

The word "metastasis," which literally means stand over or beyond, is defined by Dorland as "the transfer of disease from one organ or part to another not directly connected with it. It may be due either to the transfer of pathogenic organisms or to transfer of cells as in malignant tumors." This definition as it applies to malignant neoplasms is implicit in its reference to cellular transfer. It appears of interest to recall briefly some of the historical steps which have led to the development of this concept which now doubtlessly expresses contemporary views concerning the nature of this phenomenon.

The term metastasis was first used by Recamier in 1829 to describe the secondary growths which occurred in the brain of a woman with mammary carcinoma. Although Recamier, as well as others of his period, clearly recognized the occurrence of spread of carcinoma from its local site, their explanations for such an event were often more ingenious than plausible. Indeed, Virchow, in his classical treatise, *Cellular Pathology*, in 1863 paradoxically regarded neoplastic spread as the result of the circulation of tumor juices rather than cells through lymphatics and veins to other tissues provoking the reproduction of a mass at such sites similar in nature to that form which such humors were derived. How else might metastases escape the lung or appear in such sites as the liver when the former organ was considered impervious to particulate matter reaching it through these vascular channels? Although the careful studies of Thiersch and Waldeyer established that metastases occurred by cellular emboli, it remained until 1952 when Zeidman and Buss demonstrated that tumor cells could traverse not only lungs but other organs that Virchow's dilemma was solved with finality. More recent studies performed in our laboratory utilizing ^{51}Cr -labeled Walker tumor cells in the rat and the Brown-Pearce and V2 carcinomas in the rabbit also appear significant in this regard. It was observed following intrajugular and intraportal injection of tumor suspensions of these tumor cells that they did not lodge in the first organ encountered. Also, V2 cells less readily traversed

the lung than those of the Brown-Pearce type following intrajugular injection. These studies not only reaffirm those of Zeidman and Buss, but also indicate that the distribution of tumor cells is not governed principally or exclusively by mechanical factors, a view popularized with the recognition of the cellular nature of tumor emboli.

It appears pertinent to note that the embolic nature of metastases was challenged in 1922 by Handley who advanced the concept that extension occurred by permeation of lymphatic channels. His views undoubtedly provoked the attention of investigators to the lymphatic spread of cancer which was so prevalent until the past decade. Indeed, it does not appear facetious to indicate that concepts relating to the spread and treatment of cancer during this period were for the most part influenced by those "worshipping at the shrine of the lymph node." The failure of subsequent pathologic studies to substantiate Handley's views led to the conventional considerations that tumor emboli become arrested in lymph nodes. Their growth obstructs afferent pathways which may represent a temporary barrier to tumor spread, or secondary emboli may lodge in another member of the nodal group. Retrograde lymphatic embolization or the bypass of some lymph nodes in a particular region also have become recognized events. More recently it has become established that tumor cells may traverse lymph nodes. Injection of Walker, Brown-Pearce, and V2 carcinoma cells in afferent lymph channels of popliteal lymph nodes or foot pads of rabbits was attended by prompt recovery of such cells from the cannulated efferent channels. It would therefore appear that lymph nodes do not represent the impervious barriers to tumor cells as has been previously contended and differ in their behavior in this regard from red blood cells which are effectively trapped in such structures. Although it was formerly considered that tumor cells within the thoracic duct emptied directly into the veins at the base of the neck from which they entered the vascular compartment, this concept also merits modification. Zeidman observed afferent pathways from the thoracic

duct directly to mediastinal, intercostal, and supraclavicular nodes. Thus, metastases in supraclavicular lymph nodes from carcinoma of the stomach (Virchow's, Troisier's, sentinel node) may arise from emboli from the thoracic duct rather than following obstruction and retrograde extension from the duct.

During the past decade much interest has been directed to the significance of blood-borne tumor cells. This was in large part prompted by the cytological demonstration of tumor cells in mesenteric venous blood of patients with colorectal carcinoma by Fisher and Turnbull and Engell in 1955. Since then, many investigators employing a variety of techniques have demonstrated tumor cells in blood draining from many types of neoplasms, as well as in the peripheral blood of patients with cancer. Of particular note has been the demonstration of apparently increased numbers of cancer cells in the blood following various diagnostic procedures. At present the prognostic significance of the presence of circulating tumor cells is uncertain. This view is based on the favorable clinical course exhibited by many patients in whom such cells have been observed. However, it appears significant to note in this regard that the periods of observation might be considered relatively brief, in some instances only two years. Indeed, recent awareness that tumor cells may exhibit variable dormancy suggests that the customary five-year and ten-year follow-up periods may be an unreliable index of neoplastic behavior.

The revived interest in the dissemination of tumor cells by the blood vascular compartment has tended to minimize the role of the lymphatics in tumor dissemination. Yet, it is becoming increasingly evident that it is no longer tenable to subjugate one system to the other in the phenomenon of metastases. Recent studies in our laboratory which clearly demonstrate that tumor cells within the blood vascular compartment recirculate through lymphatic channels in a cyclical manner complement prior observations on the access of lymph-borne tumor cells to the general circulation. This information provides a unified concept concerning the interrelationship of these two vascular systems.

Awareness of the frequency of circulating tumor cells in patients with malignant disease as well as their uncertain relationship to prognosis naturally has provoked inquiry regarding the fate of such cells. It is to be emphasized that the presence of tumor cells within vascular channels does not constitute a metastasis. The attainment of an extravascular position of such cells appears to represent, as emphasized by Willis, the crucial period in determining

whether tumor cells will develop into a metastasis. The microcinematographic studies of Wood and Zeidman have provided some insight into the mechanism involved in this phenomenon. Following lodgment of tumor cells, which may be related to a peculiar "stickiness" to endothelium, they become surrounded by a micro clot. Leukocytes which occur at such sites traverse defects in the vascular wall and are followed by tumor cells. This entire process may occur within 48 hours. This information, as well as other evidence, suggests that the coagulation mechanism may play a significant role in metastasis formation. Indeed, administration of heparin or plasmin has been noted to reduce the incidence of experimental metastasis.

Although thrombus formation is frequent, there is also evidence that it does not represent an invariable feature of metastasis formation. That the tumor cells per se may possess inherent qualities favorable or unfavorable for metastasis formation is apparent from the studies of Greene and Rabotti. The significance of qualitative change in the tumor cell in this phenomenon was clearly demonstrated in our laboratory when it was observed that Walker tumor cells surviving isolated perfusion with nitrogen mustard for 72 hours exhibited a marked propensity for metastasis formation. This behavior could be demonstrated to be related to changes in the tumor cell rather than host and interestingly was correlated with obvious morphologic anaplasia of the tumor cells.

Much recent investigation concerning factors influencing the development of metastases has been directed toward the host's contributions to this process. Such an approach encompasses the general view expressed in 1889 by Paget who, being skeptical about the purely mechanical explanation for the predilection of metastases for certain organs and tissues, proposed the concept that certain tissues, e.g., liver, possessed a favorable "soil" for such growth, whereas others, such as spleen, thyroid, and skeletal muscle, were intrinsically unfavorable. Our own studies with labeled tumor cells cited previously indicate that the anatomic pathways, as well as soil and properties of the tumor cells themselves, contribute to such a phenomenon. However, recent studies leave little doubt that the alteration of the soil within a particular organ may profoundly influence the incidence as well as growth of metastases within it. The results of our own investigations concerning hepatic metastases clearly indicate the augmenting influence of hepatic trauma induced by a variety of local or systemic modalities on such tumor growth. The significance of hepatic trauma is epitomized

mized by those experiments in which rats received intraportal injections of as few as 50 Walker tumor cells. Livers of these animals were first inspected 13 weeks following injection. Although none exhibited metastases at this time, subsequent examinations at weekly intervals resulted in 100 percent incidence in those surviving the experiment at 20 weeks. On the other hand, control animals receiving a similar number of tumor cells prepared from the same donor tumor all failed to exhibit metastases when first examined at 20 weeks following injection. Thus, the relatively simple process of laparotomy and hepatic manipulation for inspection of this organ for metastases was capable of stimulating tumor cells, which were residing in the liver in a dormant state of "peaceful coexistence," into active growth. This experiment represents an experimental counterpart to the well-recognized observation of the occurrence of metastases after inordinately long latent periods with some neoplasms in man. It also provokes consideration that the aphorism proposed by Goldmann in 1897 that all tumor emboli do not represent metastases might be justifiably modified to indicate that all tumor emboli may represent potential metastases. As yet, the precise mechanism whereby trauma produces such an effect is inapparent. It appears unrelated to rheological alteration, or the elaboration of a humoral growth-promoting factor from the liver and is independent of adrenocortical activity.

Further evidence implicating the soil in metastasis formation is provided by studies in which hepatic protein or lipid content is altered by dietary means. High protein or high-fat, choline-free diets have been found to be associated with an increased incidence, as well as size of metastases, whereas the converse has been noted when hepatic protein is reduced. Contrary to the popularly held view relating the frequency of metastases in the liver to its relatively high glycogen content is the failure to note any effect of alteration on this component on experimentally induced metastases.

It is uncertain whether the influence on hepatic metastases exerted by such systemic factors as hypophysectomy mediates its effect by altering the liver or by other means. Hypophysectomy represents one of the most effective experimental modalities observed to inhibit metastasis formation. By assessing the substitutive effects of various tropic hormones on the latter it was noted that prolactin, as has been suspected in some human mammary carcinomas, may represent a significant tumor-promoting factor of pituitary origin. It is of interest that growth hor-

mone lacks such an effect, at least on the experimental model in which it was tested.

It has long been suspected that some tumor cells which are circulating or lodged in extravascular loci may be destroyed either by specific or nonspecific host mechanisms. Yet, there is only meager evidence to substantiate such a view. Our own studies militate against the view relating tumor resistance to reticuloendothelial activity. Also, neonatal thymectomy resulted in a decrease rather than increase in metastases which might have been expected if this phenomenon were related to the development of immunologic competence. It appears cogent to note that such animals were tolerant of skin homografts suggesting that the problems of skin and tumor transplantation may not be synonymous. The results of these experiments obviously should not preclude considerations relative to the possible immunologic mechanisms which may participate in the phenomenon of metastases. Yet at present, the view of Wallace in this regard appears appropriate when he indicated: "While an immunologic explanation of the failure of some metastases to appear is an appealing one, it explains one phenomenon by assuming the presence of another which has not yet been proven to exist."

This relatively brief report concerning the problem of metastasis is not intended to be totally inclusive or exhaustive. Undoubtedly the reader has already recognized that little or no mention has been made concerning the factors leading to and influencing tumor cell invasion which represents the initial, and certainly a highly significant, phase of metastasis formation. Also, many of the experiments cited represent experiences with only one tumor in one model system. That various tumors may exhibit divergent behavior in regard to metastasis formation has been noted in this report. Although some data obtained as yet has no clinical parallel, nevertheless the similarity in other instances is striking. The prime intent has been an attempt to indicate some of the more recent findings and considerations of metastasis formation, particularly as they may fit into its conceptual framework.

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(The references may be seen in the original article.)

THERAPEUTIC BRONCHOGRAPHY IN THE TREATMENT OF BRONCHOPULMONARY TUBERCULOSIS *

Gilles Lorange MD FCCP, Montreal, Canada, *Dis Chest* 51(3):241-247, March 1967.

Since the treatment of pulmonary tuberculosis was first placed on a scientific basis, three different phases have been clearly discernible. The first may be called the *hygienic phase* and consisted of sanatorial treatment. The second, directed to *specific treatment*, is concerned with specific drug therapy and surgical resection. Finally, the most recent phase has just begun and has to do mainly with *prophylaxis*.

We live actually in the era of specific treatment. The last 20 years have witnessed the appearance of many antibiotic drugs which have been employed in different therapeutic regimens either alone or in conjunction with surgical resection. Medical journals concerned with chest disease are replete with articles on this subject.

Among these, the author was particularly intrigued by the report of Carabelli, published in 1958, on the endobronchial treatment of pulmonary tuberculosis. The favorable results reported encouraged us to repeat, with slight modifications in technique, his research, with particular regard to its practical applications in a large general hospital and in the out-patient clinics.

The following is an initial report on our experience.

Technique

The method is that which is usually employed by the author and co-workers in bronchography, the only difference being that the therapeutic agent is incorporated with the contrast material and selectively deposited within the affected pulmonary region by means of an endobronchial catheter.

The patient is premedicated with a barbiturate, atropine and alphaprodine hydrochloride (Nisentil). Sensitivity tests to cocaine and tetracaine hydrochloride (Pontocaine) having been carried out previously, the oropharynx and larynx are anesthetized with a vapor spray of one or the other of these

substances. The endobronchial instillation of lidocaine (Xylocaine) completes the required anesthetic preparation.

Once local anesthesia has been assured, a Metras catheter is inserted into the trachea.

The distal curve of the catheter is chosen according to the site of the lesion. Under fluoroscopic control, the catheter is directed into the appropriate draining bronchus and the therapeutic agent therein deposited. This consists of a suspension containing 1 gm of isoniazid mixed with 20 ml of propylidone (Dionosil oily). Following the endobronchial injection, the patient must remain, for a period of three to four hours, turned on the side affected. In addition, our patients all received an average oral dose of 400 mg of isoniazid per 24 hours.

Rationale of Treatment

As Carabelli so well demonstrated in his original article, this technique of endobronchial instillation has several undeniable advantages. It permits high local concentration of the drug, higher than can be achieved by the oral route because of the edema, endarteritis and fibrosis surrounding tuberculous lesions. It has been estimated that the oral administration of isoniazid based on 3 to 4 mg per kilo of body weight (approximately 300-400 mg), would assure a plasma level of 1.3 to 3.4 gamma/per ml, while in comparison, the endobronchial administration of 500 mg of isoniazid would deliver a concentration of 842 gamma per ml within the pulmonary parenchyma. Furthermore, it is logical to believe that the phagocytic cells, having engulfed the medication, serve as efficient carriers of the drug transporting it to all active sites, following the same infecting route as the *Mycobacterium*, there exerting its specific antibiotic action.

Isoniazid was chosen over streptomycin and PAS for several reasons: minimal toxicity, rapid absorption, bacteriostatic and bacteriocidal potency, the latter at times dramatic, and its rapid penetration of the cellular membrane.

* From the Department of Medicine and Chest Clinic, Notre Dame Hospital and University of Montreal.

Results

This report comprises 37 consecutive patients treated by therapeutic bronchography between 1959 and 1964. It was decided to utilize this technique in the treatment of all tuberculous cases confined to our care, regardless of the type or extent of the lesions involved. Of 37 cases, sputum examinations demonstrated the Koch bacillus in 27, while ten cases had negative sputa. Among this latter group, however, the clinical and radiologic picture was characteristic.

The type lesion treated was, in the majority of cases, a cavitary lesion, but also included were bronchiectatic and infiltrating lesions, fibrocaceous pneumonias and stenosis with bronchial ulceration.

Results were classed as either successes or failures. There were 81 percent successfully treated, 62 percent having been sputum-positive and 19 percent sputum-negative.

Table 2 illustrates the basis of the foregoing classification. In pulmonary tuberculosis, the principal criteria by which a therapeutic regimen should be evaluated are:

- 1—bacteriologic conversion of sputum;
- 2—radiologic evidence of diminished activity either by a decrease in the size of the cavities, or by a regression of the exudative reaction;
- 3—signs of cessation of tuberculous activity as determined by radiologic clearing or by the appearance of a stable fibrotic scar.

Of the patients with positive sputum, 18 cases demonstrated cavitary lesions. They received, on the

TABLE 1
THERAPEUTIC BRONCHOGRAPHY
TYPE OF LESIONS

| | |
|----------------------------|----|
| <i>Positive sputum:</i> | |
| Cavities | 22 |
| Bronchiectasis | 2 |
| Infiltration | 1 |
| Fibrocaceous pneumonia | 1 |
| Bronchial stenosis (acute) | 1 |
| | 27 |
| <i>Negative sputum:</i> | |
| Cavities | 7 |
| Infiltrations | 3 |
| | 10 |

average, four endobronchial instillations with a 15-day interval between treatments. Sputum conversion was obtained on the average in 69 days, the first signs of radiologic improvement in 18 days, and cessation of all activity in 140 days.

Two cases of tuberculous bronchiectasis are included in the series. Sputum conversion averaged out to 25 days, the first signs of radiologic improvements to 11 days and cessation of all activity to 105 days. Pulmonary infiltrative lesions would appear to respond more quickly with this technique as "cure" (cessation of activity) was obtained in 90 days.

It may appear peculiar to include in this series a patient suffering from fibrocaceous pneumonia, classified as "cured" after 550 days, but it should be

TABLE 2—THERAPEUTIC BRONCHOGRAPHY
RESULTS 1959 - 1964
SUCCESSFUL RESULTS 81 PERCENT

| Type of lesions | No. cases | Average No. bronchography per patient | Average time for conversion | Average time for radiologic improvement | Average time for "cure" |
|----------------------------|-----------|---------------------------------------|-----------------------------|---|-------------------------|
| <i>Positive Sputum</i> | | | | | |
| Cavities | 18 | 4 | 69 days | 17.6 days | 140 days |
| Bronchiectasis | 2 | 4 | 25 days | 11 days | 105 days |
| Infiltration | 1 | 6 | 40 days | 14 days | 90 days |
| Fibrocaceous pneumonia | 1 | 5 | 175 days | 92 days | 550 days |
| Bronchial stenosis (acute) | 1 | 5 | 34 days | 19 days | 120 days |
| <i>Total:</i> | 23 | 4 | 71 days | 22 days | 152 days |
| <i>Negative Sputum</i> | | | | | |
| Cavities | 5 | 3 | — | 16 days | 87 days |
| Infiltrations | 2 | 3 | — | 52 days | 197 days |
| <i>Total:</i> | 7 | 3 | — | 26 days | 119 days |

TABLE 3—THERAPEUTIC BRONCHOGRAPHY
RESULTS 1959 - 1964
STUDY OF CAVITIES: ACCORDING TO THE DIAMETER + NUMBER

| Diameter | | Average No. bronchography per patient | Average time for conversion | Average time for radiologic improvement | Average time for "cure" |
|----------------------------|---------------------------|---|--------------------------------|---|----------------------------|
| <i>Unilateral cavities</i> | | | | | |
| | 0 — 2 cm. (4 cases) | 4 | 42 days | 16 days | 64 days |
| <i>Positive</i> | 2 — 4 cm. (6 cases) | 4 | 55 days | 18 days | 110 days |
| <i>Sputum</i> | 4 — + cm. (4 cases) | 5 | 116 days | 16 days | 226 days |
| | TOTAL AVERAGE: (14 cases) | 4 | 73 days | 16 days | 135 days |
| | 0 — 2 cm. (3 cases) | 3 | — | 21 days | 83 days |
| <i>Negative</i> | 2 — 4 cm. (2 cases) | 3 | — | 9 days | 95 days |
| <i>Sputum</i> | TOTAL AVERAGE: (5 cases) | 3 | — | 16 days | 87 days |
| <i>Bilateral cavities</i> | | | | | |
| <i>Positive</i> | | | | | |
| <i>Sputum</i> | 0 — 2 cm. (14 cases) | 4 | 48 days | 22 days | 175 days |
| <i>Negative</i> | | | | | |
| <i>Sputum</i> | 0 | | | | |

pointed out that the patient had positive sputum, was an alcoholic and totally uncooperative, had been hospitalized on various occasions in several sanatoria, and had a history of active tuberculosis of over 15 years' duration. To cure this patient and return him to a normal life was indeed a challenge. A case of bronchial stenosis with ulceration was converted in 34 days, with diminution in the bronchial stenosis in 19 days and complete inactivation in 120 days.

Among the cases with negative sputum, the cavitary lesions responded more rapidly. Radiologic improvement occurred in 16 days and cessation of activity in 87 days, while the infiltrating lesions were more refractory to treatment. The number of treatments required for each patient and the interval between treatments varied considerably. Our initial inexperience and hesitation at the beginning were among the several factors accounting for these variations. In addition, all cases were treated in consecutive fashion without any selection. However, it can be stated that during the past two years, as experience has been acquired, for the most part installations are carried out on a weekly basis with even more rapid success than the average presented in this series.

Table 3 analyzes the results in the cavitary lesions based on the diameter and number of cavities. It is evident that the smaller the cavity, the more quickly

the bacteriologic conversion and radiologic cure are obtained. It is also apparent that these changes occur with approximately the same interval in the patients with negative sputum. When the patient presents bilateral cavitary lesions, improvement takes longer than in cases of unilateral cavitary lesions of comparable size.

Relapses occurred in three cases. Common underlying factors were alcoholism, the cessation of oral treatment and general lack of cooperation.

Complications were rare and insignificant. Nodular lesions simulating bronchopneumonia were seen in eight cases in the first 24-28 hours following therapeutic instillation. Despite their somewhat alarming radiologic appearance, these lesions rapidly disappear within a few hours following symptomatic treatment with aerosols and expectorants. The oily suspension seemed to be the responsible factor since the substitution of an aqueous suspension in later cases caused no such complications. One other complication was observed in one case, viz. an episode of asthmatic bronchitis.

Discussion

If we compare this series with those reported by Carabelli and Saeed, it is apparent that in so far as sputum conversion and complete cure are concerned, the results are quite comparable.

It is, however, impossible to appreciate the time factor in the cases reported by Saeed. We could find, in the recent medical literature, only one other published report, that of Titshe *et al.* These latter authors reported seven cases of chronic fibro-cavitary tuberculosis, treated by the endobronchial installations of isoniazid without any success whatever. Their conclusions are directly opposite our own experience of one case and that of Carabelli.

Dairov reported a series of 50 cases treated by endobronchial instillations using a Metras catheter. The therapeutic agent consisted of a mixture of streptomycin, isoniazid, penicillin and hydrocortisone. In the brief summary of his article, which was written in Russian, it is not possible to evaluate his work properly, but complete cure was obtained in 29 cases, the remaining 21 being cases of chronic fibrotic tuberculosis with bronchial stenosis.

Two reports on methods similar to our own bear mentioning. Kozlov employed the endotracheal instillation of a mixture of streptomycin and penicillin. This instillation is achieved by means of a syringe and a laryngeal mirror, and cure was obtained within three months. Bonelli and associates described a method of local treatment by the intratracheal insertion of a polythene tube across the crico-thyroid membrane. This tube then facilitated the daily perfusion in the affected tuberculous zone with adequate specific antibiotherapy.

If the results obtained by therapeutic bronchography are compared with those obtained by classic treatment, based on the duration of sanatorial hospitalization and chemotherapy, it is very difficult to arrive at a just comparison. The type of lesions involved, their localization and extension, and their toxicity, are variable factors which warrant against valid scientific comparisons between the hundreds of series of cases published in the medical literature. Certain statistics did, however, seem pertinent. Hollander reported that in cases of moderately advanced cavitary tuberculosis only 45 percent were negative after one month treatment, and 90 percent after six months. Coulthard of the Toronto Hospital for Tuberculosis reported that the average sanatorial stay was 5.5 months; after nine months, 90 percent of the patients had negative sputa. Lichtenstein reported the average sanatorial stay as seven months and 90 percent had sputum conversion between the sixth and eighth months of treatment.

Summary and Conclusion

The results obtained with a new technique in the treatment of pulmonary tuberculosis, that of thera-

TABLE 4
THERAPEUTIC BRONCHOGRAPHY
COMPARATIVE TABLE OF RESULTS
POSITIVE SPUTUM

| | Carabelli | Saeed | Lorange |
|--|-----------|-------|---------|
| Number of cases | 18 | 30 | 27 |
| Sputum conversion (%) | 86% | 80% | 85.5% |
| Sputum conversion (Time) | 96 days | — | 75 days |
| Successful results (according to criteria) | 82.5% | 80% | 81% |

peutic bronchography, have been presented. This method brings directly to the site of the active lesion a much higher concentration of the therapeutic agent than that obtained by the classic oral route. It produces sputum conversion and cure more rapidly in 81 percent of the observed cases. It is particularly effective in cases of recent development, and less rapidly, but just as effectively in chronic cases providing that the draining bronchus is still permeable. Cavities of 4 cm diameter or less are more effectively treated by this technique. This method is relatively simple, is well tolerated by the patient, and has produced only rare temporary complications which are without serious consequence.

It is not a panacea in the treatment of active pulmonary tuberculosis and should be associated with the customary general treatment. Its value has been noted in cases of cavitary pulmonary tuberculosis with positive sputum as well as negative sputum, acute cases of tuberculous bronchitis, tuberculous bronchiectasis and chronic tuberculosis. However, this report does not cover a sufficient number of cases to draw any definite conclusion regarding this therapeutic technique in this latter regard.

The case failures which were experienced are attributable to already developed resistance to isoniazid, to certain allergic reactions, to character defects and finally to associated conditions such as cancer and pulmonary fibrosis.

Acknowledgments: I wish to thank Dr. Léo-R. LaFlèche for his translation from French to English.

I am grateful to Drs. André Mackay and Gildo Renzi for their permission to include some of their cases in this series.

(The omitted figure and references may be seen in the original article.)

MEDICAL ABSTRACTS

RECURRENT HEMATURIA AND FOCAL NEPHRITIS

T. F. Ferris MD, Phillip Gorden MD, Michael Kashgarian MD, and F. H. Epstein MD, (From the Departments of Medicine and Pathology, Yale University School of Medicine, New Haven, Connecticut.)
New Eng J Med 276: 770-775, April 6, 1967.

This is a study of the clinical and pathological features of 11 patients ages 15 to 35 with repeated episodes of hematuria. Only two of the patients had typical microscopic changes of chronic diffuse glomerulonephritis. In the others, the changes were confined to focal glomerulitis or the glomeruli were normal. Although episodes of hematuria were often preceded by upper-respiratory-tract infections, there was no evidence for a preceding streptococcal infection in any of the patients with focal nephritis. The focal glomerular changes were similar in some respects to those which have been described in lupus erythematosus, Wegener's granulomatosis, hypersensitivity angiitis, Henoch-Schönlein purpura, and bacterial endocarditis, but there was an important distinction in the authors' material: no necrosis and no capillary thrombi in the glomeruli. The authors emphasize the importance of establishing the histologic nature of the renal lesion in patients with repeated episodes of hematuria.

OBSTRUCTION IN CANCER OF THE COLON

C. E. Floyd MD and Isidore Cohn, Jr. MD, (From the Department of Surgery, Louisiana State University School of Medicine, New Orleans, Louisiana.)
Ann Surg 165: 721-731, May 1967.

This is a review of 512 cases of obstructing cancer of the colon, rectum, and anus found in 1,741 patients with cancer of these areas admitted to the Charity Hospital in New Orleans during the period 1 January 1948 through 31 December 1963. Two hundred forty of these had complete and 272 partial obstruction. The five-year-survival rate was 15 percent in the completely obstructed ones, and 19 per-

cent in those with partial obstruction. (Survival rate in those without obstruction in the total series was 27 percent.) Sigmoid cancers caused most of the complete obstructions and sigmoid and rectal cancers caused partial obstruction with equal frequency. The operative mortality for all decompressive procedures was 24 percent but the rate for decompression only was 50 percent; operative mortality for definitive resections was 10 percent for complete and 17 percent for partial obstruction. The survival rate was extremely poor in rectal cancers with any element of obstruction. Greater differences in survival rates were found on the basis of location of the lesion than on the completeness of the obstruction. The five-year-survival rate was better in those patients with obstruction on the left side than in those with obstruction on the right. The latter had a better prognosis than those with rectal obstruction. The authors feel that the improved survival rate of patients with left-sided lesions is related to the type and the extent of the lesion as well as to other factors—earlier detection of the lesion, character of the colon contents. In the rectal cancers, late appearance of obstructive symptoms, lack of serosal covering, and avenues of spread of rectal lesions, they believe, play a major role in the poor prognosis associated with these lesions. Emphasized as a pitfall in colonic surgery is failure to recognize an element of partial obstruction.

CARCINOID-ISLET CELL TUMORS OF THE DUODENUM

Rudolph Weichert MD, Richard Reed MD, and Oscar Creech, Jr. MD, (From the Departments of Surgery and Pathology, Tulane University School of Medicine, New Orleans, Louisiana.)
Ann Surg 165: 660-669, May 1967.

Among 16 cases of duodenal tumor, 13 were discovered at operation; ten patients had ulcers and three had polypoid lesions diagnosed radiologically. The other three tumors were found at necropsy. Six patients had symptoms compatible with the Zollinger-Ellison syndrome, and four had symptoms of chronic duodenal ulcer alone.

Similarity in microscopic appearance did not permit distinction of carcinoid from islet cell tumors. We propose that carcinoid and islet cell tumors share a common origin in the argentaffin cell, for the following reasons:

1. Histologically the tumors are indistinguishable.
2. The argentaffin cell, thought to be the parent cell of carcinoid tumors, can be traced embryologically to the islets of Langerhans.
3. Functioning carcinoid and islet cell tumors have been found in the stomach, duodenum, pancreas, liver, and bronchi. Argentaffin cells are present in these derivatives of the foregut.
4. Pancreatic islet cell tumors and metastatic tumors resembling carcinoid and islet cell tumors produce insulin.
5. Pancreatic and duodenal islet cell tumors produce insulin and the Zollinger-Ellison syndrome.
6. Pancreatic ductal, acinar, and islet cell tumors produce serotonin and the carcinoid syndrome.
7. The urine of a patient with an ulcerogenic tumor of the duodenum contained 5-Hydroxyindole acetic acid.
8. Carcinoids of the foregut are associated with increased incidence of gastrointestinal ulcers.

In patients without hypersecretion, treatment of ulcerogenic tumors of the duodenum consists in removal of the tumor and partial gastrectomy with or without vagotomy. Even in patients with hypersecretion, partial gastrectomy is indicated if the tumor can be removed completely; incomplete removal necessitates total gastrectomy.—Authors' summary.

PROLONGED VENOUS CATHETERIZATION AS A CAUSE OF SEPSIS

Helen Smits and L. R. Freedman MD, (From the Department of Internal Medicine, Yale University School of Medicine, New Haven, Connecticut.) New Eng J Med 276: 1229-1233, June 1, 1967.

A survey of all patients with positive blood cultures on the adult medical and surgical services of the Yale-New Haven Hospital to study the incidence, etiology, and clinical course of sepsis in that Medical Center was begun in January 1966. It soon became apparent that polyethylene cannulas, whether placed for intravenous therapy or to measure venous pressure, were a major source of sepsis. This

report describes ten patients, nine with septicemia and one with endocarditis, in whom blood stream dissemination of bacteria resulted from infection complicating venous catheterization. During a seven-month period of study, "cannula sepsis" represented approximately nine percent of the total number of cases of sepsis, approximately half of the cases of staphylococcal sepsis in the entire hospital were attributable to complications of venous cannulation; other bacteria recovered included klebsiella, *Escherichia coli*, *Streptococcus viridans* and *Clostridia perfringens*. The sepsis responded satisfactorily to therapy in five but in four others oliguria, azotemia, and shock developed. The authors urge that venous catheters, however inserted, should be placed only when absolutely necessary, maintained with appropriate aseptic and antibiotic precautions and removal as soon as possible and they state that if the need for catheterization still exists after 48 hours of proper maintenance, a new catheter should be placed at another site.

NONTUBERCULOUS PULMONARY PARENCHYMAL CONDITIONS PREDISPOSING TO SPONTANEOUS PNEUMOTHORAX—REPORT OF FOUR CASES

D. E. Dines MD, O. T. Clagett MD, and C. A. Good MD, (From the Mayo Clinic and Mayo Foundation, Sections of Medicine, and Roentgenology.) J Thorac Cardiovasc Surg 53: 726-732, May 1967.

The authors report extensive studies of patients with spontaneous pneumothoraces occurring in four patients, one with histiocytosis X, one with scleroderma, one with chronic diffuse interstitial pneumonitis, and one with chronic bronchiectasis. In discussing treatment, they state that pulmonary parenchymal conditions in which there is associated lung disease with honeycombing generally develop too large a leak with spontaneous pneumothorax to be considered for conservative treatment and that intubation should be carried out as soon as possible. If the pneumothorax recurs or if there is a persistent large air leak, thoracotomy is indicated.

In their opinion, the cysts of honeycomb lungs are acquired and develop from obliteration by fibrosis or by granulation formation of respiratory bronchioles and their subdivisions.

DENTAL SECTION

TECHNIQUE FOR FABRICATION OF A BITE GUARD IN ONE APPOINTMENT

G. M. Bowers and W. G. Hillis.

The bite guard is an "acrylic shoe"¹ having a relatively flat biting surface that fits over the occlusal portion of the teeth and conforms to the occlusal plane of the opposing teeth.

Indications

The bite guard is used for many different reasons. Probably its greatest application is in the treatment of bruxism. Bruxism, subconscious occlusal grinding or gritting of the teeth, has been related to both deep-seated neuroses as well as occlusal permuturities, and is a potential source of injury to the periodontium. The bite guard serves to minimize the injurious effects of bruxism until adjustment of the occlusion is accomplished or until emotional tension or anxiety is reduced. The guard will also prevent the extensive wear of the occlusal surfaces so frequently observed with bruxism.

The bite guard is likewise used to great advantage in the alleviation of the acute symptoms of temporomandibular joint disorders and muscle spasms related to occlusal disharmonies. The rationale for its use is the elimination of all occlusal interferences and the reduction of pain and muscular spasm prior to adjustment of the occlusion.

Other indications for the use of a bite guard are: temporary splinting of mobile teeth, as an orthodontic retainer after minor tooth movement, to prevent trauma to palatal tissue (e.g. deep overbite), to test patient adaptability to a decrease in interocclusal space prior to the construction of 'bite-raising' prostheses and to prevent extrusion of unopposed teeth.

Fabrication Technique

There are several techniques described for the fabrication of bite guards, the majority of which require the services of a prosthetic laboratory. A technique has been devised which permits the cli-

nician to take the impression, fabricate, and insert the guard in one appointment without the use of laboratory facilities.

The procedure for constructing a 'one-appointment bite guard' requires the procurement of a precision vacuum adapter* and assorted sheets of resin material**. The technique is as follows:

1. An alginate impression is taken and a cast is made from rapid-setting plaster.

2. The cast is trimmed to an oval shape to remove all sharp edges and permit an adequate vacuum seal. A pencil line is scribed at the height of contour of the teeth on the cast. Deep undercuts are blocked out and edentulous areas are partially filled with special compound supplied by the manufacturer.

3. A sheet of .060 clear resin material is secured in place and the vacuum adapter is used according to the manufacturer's recommendations. It is suggested the resin material be pressed into the interproximal regions with a pencil eraser while in a plastic state to increase the retention of the bite guard.

4. Edentulous areas are reinforced with rapid-set acrylic prior to removal from the cast.

5. The bite guard is removed from the cast with a Silicon-Carbide Disk and trimmed with a SHP, Denture Trimming Bur (6520-076-8682). Burs other than the type specified have been unsuccessful in trimming the resin material.

6. The bite guard is inserted and checked for proper fit.

7. Rapid-set acrylic is mixed in a dappen dish and placed on the occlusal surfaces of the bite guard. The guard is reinserted and the patient is guided into centric relation occlusion. He is then asked to tap lightly into the soft acrylic material. The bite guard is removed and placed in warm water for 1-2 minutes.

8. The rapid-set acrylic is ground to narrow the occlusal table and to leave a shallow registration of

¹ Goldman, H., Schluger, S., Fox, L., Cohen, D. W.: *Periodontal Therapy*, page 750, third edition, C. V. Mosby Company, St. Louis, Missouri, 1964.

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Harrisburg, Pa. 17105
**Omnidental Corporation

the occlusion. Adjustment is continued, using articulation ribbon, until maximum contact is achieved over the long axis of the teeth. All teeth should contact the bite plane on the working side (group function) with no contact on the balancing side.

9. Milling and polishing cream (6520-500-0400) is placed on the occlusal surface of the bite guard and the patient is asked to slide in every possible direction until a smooth, even, glide is achieved.

10. The bite guard is removed, polished, and final insertion is accomplished.

11. In certain cases, it is not possible to adequately adjust the occlusion due to pain, muscle spasm, or trismus. It is recommended that resilient guard material (1.50) be used, negating the need for adjustment of the occlusion. The resilient material has been found to achieve the desired results but wears more rapidly than the firm resin materials.

Advantages

Clinical experience has shown the vacuum adapted bite guard to have several advantages over the conventionally cured acrylic guard.

1. Fabrication is fast and simple.

2. Minimum equipment and space are required for fabrication. The precision vacuum adaptor has also been successfully used in the fabrication of crown and bridge forms, denture bases, impression trays, and mouth guards for athletes.

3. Only minimum adjustment of the vacuum adapted guard is necessary for insertion.

4. Variable thicknesses of resin material are available as well as rigid and resilient forms.

5. The vacuum formed guard does not tend to fracture when dropped, or during removal and insertion by the patient.

6. Rapid-set acrylic can be added to the occlusal surfaces or to the under surface to increase retention.

7. Esthetics and patient acceptance are good.

Disadvantages

The main disadvantages of the vacuum adapted bite guard are:

1. Special burs must be used to finish the guard.

2. There is more rapid wear to the occlusal surfaces than with the conventional bite guard.

Summary

A technique is described which permits the clinician to fabricate and insert a firm or resilient bite guard in one appointment. The vacuum adapted bite guard has been shown clinically to have some advantages over the conventionally cured acrylic bite guard and should prove to be a worthy adjunct in dentistry.

NURSE CORPS SECTION

MEDICAL SELF-HELP NURSING IN NATIONAL DISASTER

The following article was written by LT Perry R. Mahaffy NC USNR, on his TAD assignment to the Institute For Instructors of Disaster Nursing sponsored by the Massachusetts Civil Defense Agency.

The underground Massachusetts Civil Defense Agency's headquarters in Framingham, Mass. and the Emergency Ward of the Boston City Hospital served as facilities for, "The Institute For Instructors of Disaster Nursing." This institute was co-

sponsored by the Massachusetts Civil Defense Agency and the Office of Civil Defense, U.S. Public Health Service. Co-ordinated and spark plugged by Miss Sadie A. Corey, R.N. (LCDR NC USNR in-active reserve), who is Nursing, Personnel and Training Officer for the Massachusetts Civil Defense Agency; Miss Corey served as hostess and chairman for this outstanding program. This institute was composed of outstanding military and civilian speakers whose personal experience in disasters and with disaster preparation underscored the vital role and the nature of experiences nurses could anticipate in

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either man made or natural disasters. Plans have been established for providing the institutes four times each year.

This one week didactic and practical program, the last week in October 1966 was divided into three areas. The first area discussed what the military refers to as the strategy and logistics of A, B, C, D, warfare. This part of the program contained the following content:

- I. Organization and Mission of Civil Defense
Allen R. Zenowitz, Director, Mass. Civil Defense Agency
- II. Operations and Planning
Louis Saba, Director, Area 2, Mass. Civil Defense
- III. Resources Management
Harold J. Magee (LtCol/USA ret), Resources Management Officer, Mass. Civil Defense Agency
- IV. Management of Mass Casualties
John W. Raker, M.D., Harvard Medical School
- V. Survival in Disaster
Ingall H. Simmons, (Col/USA), Commander of Environmental Hygiene Agency; Edgewood Arsenal, Maryland
- VI. Current Trends In Chemical and Biological Warfare and The Frozen Blood Program
Lewis L. Haynes, M.D. (CAPT/USN ret), Lahey Clinic Foundation
- VII. Packaged Disaster Hospitals
Kenneth C. Brown, Public Health Advisor, U.S. Public Health Service
- VIII. Medico-Legal Aspects of Disaster
Neal L. Chayet, LL.B., Assistant Professor of Legal Medicine; Boston Univ. Law and Medicine Institute
- IX. Disaster Preparedness—A Professional Way of Life
Catherine M. Sullivan, R.N., Nurse Consultant, Division of Health Mobilization, Office of the Surgeon General, Public Health Service, Department of Health, Education and Welfare.

The above content provided a foundation for the second part of the program. "What to do and how best to do it," that underscored the institute's focus, "Medical Self-Help Training" for professional and lay population. Content covered in this area was:

- I. Recent Advances in Shock Physiology
Howard N. Harrison, Ph.D., Professor—

Department of Physiology, Tufts Univ. School of Medicine

- II. Resuscitative Care of the Wounded
Donald L. Mahler, M.D., Boston V.A. Hospital
- III. Management of Burns Under Mass Casualty Conditions
Donald P. Dressler, M.D., Boston City Hospital
- IV. Psychological Aspects of Disaster
Francis de Marneffe, M.D., Director, McLean Hospital
- V. Programs in Medical Service Including Medical Self-Help
Sadie A. Corey, R.N., Co-ordinator, Medical Self-Help Program
- VI. Emergency Maternity Service
Ellen J. Hendrickson, R.N., Boston Public Health Dept. Katherine Hardeman, R.N., Massachusetts General Hospital
- VII. Disaster Nursing Workshop
Mass. Nurses Assn. and Mass. League for Nursing
- VIII. Effects of Nuclear Weapons
Joseph L. Johnson, Radiologist, Mass. Civil Defense Agency
- IX. Medical Aspects in Use of Radiation and/or Radioactive Isotopes
Russell F. Cowing, Radiologic Physicist; New England Deaconess Hospital, Boston, Mass.
- X. Biological Effects of Radiation-Nursing Implications
Sadie A. Corey, R.N.

Nurses present at this institute early in the program realized the importance of the basic concepts of health practice. For example, the various means for decontaminating water can only be undertaken when one knows the kind of contamination present; or an individual has only so long to survive without air and when intubation or a tracheostomy is indicated it must be performed; such expectations for a nurse's performance, when the situation arises, were presented as the expected role for the nurse. Throughout the program the common thread prevailed that nurses must use conscious rationality and sound judgment in stressful demanding situations. This same concept underpins the medical self-help program for the lay public.

The medical self-help program has been developed as a program whereby the people of the United States, when the services of a physician or other

allied personnel are not available, will be prepared in time of a national disaster. The course consists of 16 hours of instruction and the goal, of the U.S. Department of Defense, Office of Civil Defense, is that at least one member of each family have instruction in the program. The course content consists of 11 lessons ranging from "Radioactive Fallout and Shelter"—"Emergency Childbirth." All 11 areas were intensively covered in the institute because all instructors for the medical self-help program will be the nurses in the U.S. who attend and complete the instructors institute. A fact most poignantly obvious as the week drew to a close was how vulnerable a medically unenlightened public can be in the event of a random natural disaster or planned or unintentional man made one.

The final day of the institute was held at the Boston City Hospital where the following content with patient presentations was presented:

I. Maxillo-facial Injuries

Richard Taylor, M.D., Dept. of Oral Surgery Boston City Hospital

II. Abdominal and Thoracic Injuries

Robert Berger, M.D., Tufts Univ. School of Medicine

III. Case Presentations—Seminar in Disaster Medical Care

Donald P. Dressler, M.D. (moderator)

Lester Williams, Associate Director, (Boston Univ.) Surgical Service, Boston City Hospital

Lon Curtis, Assistant Director, (Tufts Univ.) Surgical Service, Boston City Hospital

IV. Awarding of Diplomas

Cameron L. Hogan, M.D., Medical Officer, Mass. Civil Defense Agency

Emphasized throughout the program was the imperative need for communication of the institutes' contents to other nurses. Nurses at the Naval Hospital, Chelsea, Mass. received two inservice meetings where they were given a presentation and discussion on nursing and nurse's participation at the time of a disaster. The first presentation dealt with the "Instructor's Institute" and a discussion of current trends in disaster nursing. The second presentation was chaired by Miss Sadie Corey. At Miss Corey's presentation to the nurses at the Naval Hospital, she went into depth on the role and function of the nurse during a disaster. She also discussed how the recommendations of the Committees on Nursing in National Defense have influenced disaster preparedness. Massachusetts' institutes for instructor training in disaster nursing is being provided in an effort to establish enough instructors to actually realize the goal for every family to have at least one member prepared in medical self-help. Institutes are presently planned and scheduled for presentation quarterly.

All participants in this institute and the following discussions at the Naval Hospital, Chelsea, Mass., have highlighted the fact that when disaster occurs there must be a flexible effective means for surviving and saving lives. Greatest effectiveness and flexibility can be found in people. People who are trained for medical self-help can best save themselves and others. Also, they can better understand the need for co-ordinated and cooperative effort between civilian and military organizations during natural and man made disasters.

OCCUPATIONAL MEDICINE SECTION

OTTO FUEL II—ENVIRONMENTAL EVALUATION OF THE AIR CONCENTRATIONS

Edward Borawski, Industrial Hygienist, Naval Propellant Plant, Indian Head, Md.

The difficulty of evaluating the air concentrations of Otto Fuel vapors previous to March 1966 was the unreliability of any quantitative analytical method of analysis. A polarographic method was

developed at that time that had the sensitivity and reliability needed for the low air concentration of the Otto Fuel ingredients. Air samples taken at the various operations, nitrating, mixing, packaging,

and the clean-up procedures of this Stations Otto Fuel facilities indicated that only one of the fuel's constituents could be detected in the air, the nitrated ester component. All the data presented here is reported in ppm (parts-per-million on a volume to volume relationship) of Otto Fuel, but the calculations of the ppm were made on the basis of the

molecular weight of the nitrated ester component.

The various air concentrations of Otto Fuel measured in the past year are listed below under the heading of types of process or facility evaluated. These values can be used in predicting the approximate concentrations that could be expected in similar situations. They are as follows:

| <i>Operations</i> | <i>Otto Fuel ppm</i> | <i>Average Exposure Time</i> | <i>Comments</i> |
|----------------------|----------------------|------------------------------|--|
| (1) Nitrator | 0.33 to 1.3 | 5 Hours | Essentially a closed system |
| (2) Mixing | 2.5 | 5 Minutes/drum | Tank with an open 4 inch port |
| (3) Packaging | 2.4 | 5 Minutes/drum | Transfers under 5 lb nitrogen pressure |
| (4) Packaging | 11.4 | 5 Minutes/drum | The emptying of the storage tank |
| (5) Clean-up | 1.8 to 16.6 | 5-20 Minutes | Cleaning of equipment and catch tanks |
| (6) General room air | 0.81 | 30-40 exposures per hour | Mixing and packaging room |

The vapor pressure of Otto Fuel is reported to be 0.0877 mm mercury at 77° F., and at this temperature, the theoretical air saturation level for the fuel is 115 ppm. In actual operations, the air concentrations of any chemical reaches only a fractional part of it's saturation value when the chemical is at ambient temperatures and atmospheric pressure. The relatively low values reported in figure #1 are the expected values of Otto Fuel's nitrated ester component based on it's maximum saturation level. The first three items in figure #1 and the sixth item in figure #1 are the general air levels of Otto Fuel that can be expected in normal transferring of the fuel from one vessel or container to another unit. Items four and five are special situations that will generate hazardous levels and require added precautions.

Item four, figure #1, was the operation of transferring Otto Fuel from a large storage tank to fifty-five gallon drums under 4-5 psi of nitrogen gas. The increase of fuel air concentrations in item four over item three in the same type of operation, was due to emptying the storage tank of all it's liquid fuel. After the nitrogen pressure (atmospheric air will also present somewhat the same problem) had displaced all the liquid fuel, the nitrogen then displaced the residual vapors in the storage tank into the immediate area of the filling operation. A good practice, if possible, would be to never drain storage tanks completely. Leaving an inch or two of the fuel in the tank would effectively contain the residual vapors in the storage tank. If tanks or vessels are

to be drained, individuals in the immediate area of the operation should rely on a respiratory protection device. Measurements were also taken of the air cavities existing in Otto Fuel storage vessels to evaluate the vapor concentration. The measured Otto Fuel air values were as follows:

- (a) Empty nitrator kettle—7.1 ppm
- (b) A 55 gallon drum with approximately six inches of air above the fuel—14.6 ppm
- (c) Large storage tank with approximately ten inches of air above the fuel—3.9 ppm Item (c), the large storage tank, was designed with a fresh air supply in the tank which continually displaced the fuel vapors to an outside trap. Under these most favorable conditions, the air inside the tank contained 3.9 ppm Otto Fuel. It is apparent, that storage tanks or vessels contain appreciable quantities of Otto Fuel vapors that could produce health hazardous conditions if these vapors were displaced into enclosed working areas.

Item five, figure #1, refers to cleaning operations, but can be expanded to include accidental spills of the fuel. In both these situations individuals are exposed to large surface areas covered with a thin film of the liquid fuel. It is expected that vapor concentrations would reach relatively high levels, and this is a characteristic of all chemicals whose physical properties include a measureable vapor pressure. The procedures for Otto Fuel should follow the standard practices for all chemicals in cleaning operations which are as follows:

(a) Spills on decks or other surfaces should be cleaned as soon as practical.

(b) Covered containers used for the scrap materials to reduce fuel vapor levels in the work areas.

(c) Adequate ventilation, respiratory protection or both are needed for employee protection.

(d) The prompt removal of any contaminated clothing and soap and water wash of the affected skin areas.

Medical Effects: In all the air samples collected in the past year, analyses indicated only the presence of the nitrated ester component, and it was assumed that any effects due to inhalation of the fuel's vapor would be due to this nitrated ester. Nitroglycerin and ethylene glycol dinitrate are two nitrated esters with physical and chemical properties very similar to the Otto Fuel nitrate ester, and therefore, the fuel's medical effects should also be similar. The literature indicates the nitrate esters acute effects to be nasal turgidity, blood pressure changes, headaches and dyspnea, development of a tolerance and a cross tolerance. The tolerance effect allows individuals to increase their body burden of a nitrated ester either by inhalation or ingestion (medication for heart patients) which makes it necessary to increase dosage or exposures before any effects are noted. Cross tolerance is the development of a tolerance to a specific nitrated ester and if there is exposure or dosage to a different nitrated ester the effects are modified by the existing tolerance to the first nitrated ester.

The limited observations of Otto Fuel effects to Station personnel indicate the nitrate ester components *acute* effects are similar to the literature reports on nitrated esters. The initial effect is the nasal turgidity (blockage) and the progression to the other effects in the order listed above. The number of effects experienced are dependent on the air concentrations and length of exposure time, specifics will be treated later. One peculiarity of the Otto Fuel nitrated ester component that differs (no literature reports this for other nitrated esters) from the other ester is the very rapid recovery from any of the acute effects listed above. The breathing of air free of Otto Fuel vapors for several minutes, eliminates all the effects due to the exposure. As a consequence, no employees on station have ever reported to the dispensary for treatment due to Otto Fuel exposures. Whether tolerance can be developed to Otto Fuel vapors cannot be determined at this station because employees here have a past and present history of nitroglycerin exposure. Indications are that they have

some tolerance to Otto Fuel, but it cannot be determined if this is a direct or a cross tolerant effect due to their multiple nitrate ester exposures. The underlinement of the word acute is to emphasize the fact that all the data is based on acute effects and the long term or chronic effects, if any, are completely unknown.

The measurements of air concentration of Otto Fuel on station and the medical effects were made on actual conditions existing at the time and the individual exposures depended on the operations. Therefore, the desirable data that clearly defines Otto Fuel exposures in ppm versus medical effects is not available, however the data that is presented below can be used as a reference guide. Also, it must be pointed out that this data is based only on inhalation exposures. The observations are as follows:

(a) The threshold limit value for Otto Fuel at 0.2 ppm is a good value and indicates a safety factor. Employees exposed to slightly higher values (0.41 ppm) for five hour periods (maximum exposure time on this station) had no headaches and expressed working conditions as pleasant. All individuals reported headaches when concentrations were 1.0 ppm or greater. The lowest measured value producing headaches was 0.58 ppm with the headaches developing near the end of the five hour exposure period.

(b) Clean-up operations (spills can be included in this category) of Otto Fuel equipment or surfaces will expose individuals in these procedures to concentrations greater than 1 ppm. The most frequent measured values were in the range of 4.0 ± 0.5 ppm Otto Fuel.

(c) Otto Fuel concentrations of less than 1.0 ppm, but greater than 0.4 ppm produces a nasal irritation effect. But Otto Fuel in concentrations of 1.0 ppm and greater produces a complete nasal blockage (at 4.0 ppm, this nasal blockage occurred in 45 seconds).

This nasal turgidity effect has also been attributed to nitroglycerin exposure in the literature. The authors stated that the nasal effect takes place before any other effects develop. This is indicated to be true for the Otto Fuel component also and presents a very valuable detector for avoidance of excessive exposures. Indications are that with the irritant effect, individuals will develop no more measurable responses than headaches.

Summary

Air analyses indicate that only the nitrated ester component of Otto Fuel is a factor from the health

standpoint. The measured acute effects on individuals due to the inhalation of the fuel vapors are identical to those reported in the literature for nitrate esters, particularly nitroglycerin and ethylene glycol nitrate. Although this station has had no experiences with skin contact, skin absorption can be a significant mode of entry. Therefore, good house-keeping and personal cleanliness is a must in Otto Fuel operations. The air concentrations varied from approximately 0 to 2.4 ppm in the essentially closed

system, to as high as 16 ppm in the cleaning operations for Otto Fuel. In enclosed areas, ventilation is required, either general room air dilutions or the more preferable local ventilation exhaust controls at sites of possible Otto Fuel emissions. Storage tanks or containers contain relatively high air concentrations of the Otto Fuel vapors and they should be outside vented or controlled to prevent the vapors entry in enclosed areas. The nasal response is indicated to be a good index of Otto Fuel vapors.

A PRELIMINARY STUDY OF CARBON MONOXIDE GAS IN THE HOME

M. W. Yates RPS, Memphis, Tennessee, J Environ Health 29(5): 413-420, March-April 1967.

The effects of the inhalation of carbon monoxide in sufficient amounts to cause acute asphyxia and death are well known and have been regarded as occupational health problems for many years. However, until recently, little interest has been manifested by public health agencies in carbon monoxide as a domestic health problem.

The American Conference of Governmental Industrial Hygienists has established tolerance levels to be used as guideline standards for controlling carbon monoxide concentrations occurring in the occupational environment. These standards now permit a maximum allowable concentration of 50 ppm for an eight hour working day. However, since there are other possible sources of carbon monoxide to which individuals may be routinely exposed including the home and automobile, the total environment should be considered in evaluating the public health problems associated with this gas.

The preceding 25 years have heralded the advent of numerous improvements in domestic heating, cooking and refrigeration technology. As sources of energy, gas and electricity are fast replacing wood, coal, coke and oil. Manufactured gas is giving way to cleaner, safer natural gas. Modern heating appliances are of automatic design and electronically controlled and the older, manually operated appliances are fading into obsolescence. All of these newer innovations have contributed to our leisure and comfort and also to our safety.

Modern home construction, however, leaves little room for error in the proper installation, use and maintenance of combustion heating, cooking and refrigeration equipment if the occupants are to be

safe from exposures to carbon monoxide. The hazard of moving antiquated, poorly maintained, and ill-adjusted combustion appliances from a large, loosely constructed airy home to a smaller, tighter, modern home is not fully recognized by the general public. A gas operated refrigerator, for example, with a relatively low BTU output can become a real threat as a source of CO when placed in a small tightly constructed home with no provision for the introduction of outside dilution air or exhaust ventilation.

In order to establish more clearly the carbon monoxide problem in the home environment, the Memphis and Shelby County Health Department, in cooperation with the U.S. Public Health Service Division of Accident Prevention, conducted a preliminary study of carbon monoxide and related gases in the home environment during the 1964-1965 heating season. This study was specifically related to situations existing in the Memphis and Shelby areas of Tennessee.

One hundred and fifty exposure incidents were investigated over a six month period which corresponded to the heating season in the Memphis area. Seventy percent of the exposure incidents were discovered in the random home survey and involved persons who unknowingly were being routinely exposed to subacute concentrations of carbon monoxide. Twenty-one percent were referred by Memphis Light, Gas & Water Division and nine percent were referred by City of Memphis hospitals. For the most part these latter cases were of an acute nature.

In making the random home surveys and in investigating complaints of "fumes," it was necessary

to determine the presence of carbon monoxide, as well as its source. The presence of carbon monoxide was already established with hospital cases, and subsequent investigations were for the purpose of determining its source. Wherever natural gas burning equipment was involved, the appliance was either readjusted, retested and returned to service, or disconnected by the gas division. When other fuels were involved, the owner of the appliance was advised to contact his fuel supplier (in the case of manufactured gas) or appliance dealer in order to get the condition corrected.

The procedure for making the random survey consisted of the pre-selection of 15 city blocks, geographically distributed over the city and making door-to-door inspections for the purpose of testing appliances for carbon monoxide. The blocks selected were situated in the lower and middle class socioeconomic areas of the city because of the widespread use of unit space heating equipment in these areas.

Case finding by the random survey method provides a means for detecting individuals who are unknowingly being routinely exposed to subacute concentrations of carbon monoxide. Also, the early detection of subacute exposures can be the means by which acute and perhaps fatal cases may be prevented.

Three hundred and twenty-seven random residential inspections were made of which 285 were private homes, 29 were mobile homes and 13 were nursing homes. The investigators received excellent cooperation and the people were generally enthusiastic about receiving the service. Initially, room air was sampled upon entering a dwelling. However, this method of sampling proved unproductive and the practice was adopted of measuring concentrations of carbon monoxide being emitted in the air stream from each combustion appliance in use. Where significant concentrations were detected, alveolar air samples were taken from one or more of the non-smoking occupants in order to measure the carbon monoxide uptake of individuals being exposed.

A survey form was designed which provided for recording appropriate data on each appliance, type of ventilation in the room and a general description of the building.

A clinical report was also made on the occupants of buildings where carbon monoxide was detected. This report was designed to reflect physiological symptoms that might be related to carbon monoxide exposure. Persons who were being subjected to car-

bon monoxide exposure and who gave histories corresponding to those of carbon monoxide anoxia were recontacted from three to six weeks after the situation had been corrected in an effort to determine whether their symptoms had disappeared or improved. In cases where symptoms could be correlated with carbon monoxide exposures and blood absorption, the occupants claimed health improvement.

Results of the Study

This study was not representative of all types of combustion appliances used in the Memphis area, but dealt primarily with space heaters, water heaters and gas cooking ranges. Of the 1,061 combustion appliances tested, 25 percent were found to be contributing sources of carbon monoxide.

Mobile Homes

Of the 29 mobile homes randomly inspected, 32 percent were positive for carbon monoxide in the range of from 10 ppm to 1,000 ppm. Only three of 24 oil fired central heating systems were positive and these were in the range of 25 ppm and under. Sixteen of 25 liquified petroleum fired gas range ovens were positive in the range of 10 ppm to 1,000 ppm, and 36 percent of those positive were in the range of 50 ppm and above.

Only four mobile home occupants described symptoms that paralleled those of carbon monoxide anoxia. It is noteworthy, however, that the cooking ranges and particularly the ovens were rarely used by these occupants. All homes were equipped with an exhaust fan which was either located over or near the range.

Contributing Causes of Carbon Monoxide in Homes

The emission of carbon monoxide by gas burning appliances is due to a multiplicity of contributing causes. Once an appliance commences to emit carbon monoxide, if the situation is permitted to continue, it will grow progressively worse and may ultimately involve two or more contributing causes before an acute concentration is reached.

The common causes revealed by this study are listed in the order of their frequency of occurrence:

1. *Flame Impingement on Metal Surfaces:* This condition may occur when the flame becomes elongated due to excessive gas pressure, insufficient air or in cases where appliances are in a poor state of repair. This is also a common phenomena when a cold pot is first set on a flame, a range oven or heater is first lit, or in the initial lighting of a hot

water tank. Where this situation is of a temporary nature, it is of no particular consequence.

2. *Clogged Air Mixing Inlets:* The primary air mixing inlet on most home appliances is located near the floor where accumulated lint and dirt are readily drawn into the air orifice, resulting in its stoppage or restriction. This will usually cause the flame to become elongated and impinge on the appliance releasing CO.

3. *Poorly Designed and Improperly Modified Appliances:* Such appliances normally are not equipped with regulators and in some cases, no primary air mixers. Such appliances were frequently found to be "overriding" their gas rating and generating carbon monoxide. The reaming or enlargement of gas burner orifices in order to increase the size of the flame and get more heat unbalances the air-gas ratio and will throw the flame out of adjustment.

4. *Failure to Vent Gas Appliances Which Require Venting:* Small heating appliances are often installed by the owners with vents omitted. The general conception being that more heat can be obtained if combustion products were allowed to discharge into the house.

5. *Leaks in Combustion Chambers and Heat Exchangers:* Old and well used closed combustion type heaters frequently develop cracks in the combustion chamber and/or heat exchanger. When this occurs, combustion products are discharged into the circulating room air.

6. *Improperly Installed and Clogged Vent Pipes:* Horizontal vent pipe runs were occasionally found to exceed the limitations set by the Memphis Light, Gas & Water Division. Excessive 90° angle bends in single run vent pipe systems were also found to be contributing factors in poor draft conditions and stoppage. Vent pipes were often found installed backward, that is, the insert joints were made in opposition to the flow of gases rather than with the flow, allowing gas to seep out around the joints. Vent stoppage with either soot or rust was a common cause of carbon monoxide in homes and was due largely to poor installation and lack of preventive maintenance.

7. *Malfunctioning Appliance Regulator Valves:* Floor furnace appliance regulators subjected to routine inundation with water will eventually cease to function and may permit "overriding" of the appliance gas input rating, thereby causing the flame to become maladjusted and produce CO.

8. *Oxygen Depletion and Negative Pressure Situations:* Oxygen starvation may occur when oversized appliances are burned continuously in small tightly constructed rooms or mobile units. When the sup-

ply of oxygen is depleted, the appliance flame will become maladjusted and commence to produce carbon monoxide. This can be avoided by the direct introduction of combustion equipment in conjunction with exhaust ventilation equipment in rooms or enclosures without provisions being made for an adequate supply of makeup air may cause negative pressures with a resulting downdraft on vent stacks.

9. *Improper Use of Fuel:* The interchanging use of liquified petroleum gas and natural gas in appliances without proper modification was encountered only rarely. However, where this situation was occurring, these appliances were positive for carbon monoxide.

Clinical Data

One thousand five hundred and forty-four persons resided in the 372 homes and establishments included in this study. Of this number, 696 or 45 percent lived in homes in which one or more appliances were found to be emitting carbon monoxide in varying concentrations. Two hundred and seventy-five or 40 percent of those living in homes that were positive described symptoms similar to those of carbon monoxide anoxia. Sixty percent of those with symptoms stated that they were relieved by going outdoors.

The following histories selected from the files are illustrative of the clinical data collected.

Case No. 134—A 34-year-old female housewife, mother of 11 children slept in a room heated by a 10,000 BTU open flame space heater which was subsequently found to be emitting 400 ppm of carbon monoxide. Eight of the 12 members of the family gave a history of routine frontal headaches, eyes burning and dizziness. Three months prior to the date of this contact, the mother awoke with a severe headache, dizziness and nausea. She collapsed on the way to the bathroom. She received medical attention but continued to use the heater and to suffer identical symptoms. The heater burner was adjusted and the family no longer complained of headaches, dizziness and blackout spells.

Case No. 15—Three teenage girls suffered what was obviously acute carbon monoxide asphyxia resulting from a gas fired range oven which was found to be discharging 500 ppm of carbon monoxide through the flue exhaust and a floor furnace which was discharging 40 ppm. The case was not medically diagnosed; however, an expired air test taken from one of the victims three hours following the incident showed a 25 percent blood saturation based on an alveolar air sample. The family gave a history of

similar incidents dating back to 12 months which could be associated with the winter season and with their being at home. The family not only had "passed out" on prior occasions but routinely suffered from headaches and nausea and were being treated routinely for viral infections. The mother, now deceased, was reported to have suffered "black-out" spells, accompanied by headaches and nausea, much more frequently than other members of the family. These spells could be associated with use of the cook stove and occurred mostly when she was in the kitchen. She was hospitalized in February, 1964, where she apparently recovered without a definite diagnosis. She returned home where she was confined to the house most of the time. Her condition worsened and she was readmitted to the hospital around April 1 in a semicoma and died on April 20. The cause of death was recorded as Menengi Encephalitis. (sic) Two months following this inspection and the subsequent correction of the problem, the family was revisited and stated that they no longer suffered fainting spells, headaches and nausea, and that their general health was much improved as compared to the preceding 12 month period.

Case No. 57—Discovered by a random home inspection involved a 46-year-old housewife and three children ages nine to 16. The mother and one child complained of symptoms similar to those of carbon monoxide anoxia. Both complained of routine frontal headaches, weakness, eyes burning, dizziness, and chest pains which they associated with their being at home. The child had been absent from school for three days with characteristic symptoms. Both stated that they felt better when they were outdoors. An expired air test confirmed that they were being exposed to carbon monoxide. An examination of the gas combustion equipment in the house revealed that a gas range oven was emitting 1,000 ppm of carbon monoxide and that two space heaters and the hot water heater were emitting 10 ppm each. This particular child spent a great deal of his time while at home in the kitchen with his mother where the oven was used to heat the kitchen. After the appliances had been properly adjusted, both persons reported a marked improvement in their health and the disappearance of the characteristic symptoms.

Case No. 41—This incident involved a family of six persons, ages 2 to 30 years. The family had been suffering from frontal headaches, dizziness, weakness and nausea for 30 days prior to this contact, which they were able to associate with being at

home. Both the father and mother worked out, however, the mother had recently resigned from her job because of the ill health of the children. One of the children had become progressively worse until he was unable to attend school. He watched TV a great deal and spent much of his time in the house. He complained of severe headaches and vomited often. Although the case was not medically diagnosed, based on an expired air analysis, his blood carbon monoxide saturation level was 25 percent, two hours after the incident was reported and the house had been thoroughly aired. Another of the children, a four-year-old showed a 30 percent blood carbon monoxide saturation level at the same time. Although this second child did not appear clinically ill at the time, he gave a history of routine headaches, nausea and his complexion was flushed. Two floor furnaces were found to be emitting 300 ppm of carbon monoxide into the house which was caused by a blocked vent. Two weeks after the situation was corrected, the entire family claimed a marked improvement in their health and the disappearance of the characteristic symptoms of carbon monoxide exposure.

These case studies would tend to indicate that in homes where appliances were found to be discharging carbon monoxide, the degree of exposure by the occupants was related to the time spent in close proximity to the appliance. Because of the uncontrollable variables that existed in homes where carbon monoxide was found, no definite correlation could be made between carbon monoxide blood levels and the concentration of carbon monoxide being emitted into the room air.

Summary and Conclusion

As a result of this study, the following recommendations are made:

1. The installation of all combustion appliances should be by qualified persons.
2. Heating systems should be checked and given routine preventive maintenance at least annually by qualified persons.
3. All combustion heating appliances should be vented to the outside of the building.
4. Only the fuel designated by the manufacturer should be used.
5. Only appliances that bear the seal of a recognized approval agency should be used.
6. Open flame space heaters that are not adequately guarded, vented, and equipped with appliance pressure regulators should not be used in homes.

EDITOR'S SECTION

NAVY HOSPITAL CORPS CELEBRATES 69th ANNIVERSARY

June 17th marked the 69th Anniversary of the Hospital Corps of the United States Navy.

On 17 June 1898 the Hospital Corps came into existence as a part of the Navy Medical Department under the provisions of an Act of Congress. Initially a force of only 25 apothecaries appointed by the Secretary of the Navy, the Hospital Corps has grown to a strength of nearly 30,000 men and women encompassing 39 medical technical specialties.

Throughout the years members of the Hospital Corps have earned the respect of all for their valor and dedication to duty. Instances are continually recorded of heroic actions by hospital corpsmen in working to save the lives of fallen comrades, often giving their own lives in the effort. For these demonstrations of conspicuous gallantry "above and beyond the call of duty," 18 members of the Hospital Corps have been accorded the Nation's highest tribute, the Congressional Medal of Honor, 15 of these posthumously.

The tradition and reputation of the Hospital Corps that has been earned so dearly is being preserved and further enhanced by those serving now. On ships at sea, on nuclear-powered submarines under the polar ice cap, at medical facilities both overseas and here at home, and in the jungles and paddies of Vietnam, these men and women continue to apply their superb training, professional knowledge and indomitable esprit de corps in helping to make the Armed Forces of the United States the best cared for in the world.—Public Affairs Office, BuMed.

GEN WALT COMMENDS NAVY STATION HOSPITAL

LGEN L. W. Walt, U.S. Marine Corps, highly commended the Station Hospital, Naval Support Activity, DaNang, for the care provided the sick and injured of the Third Marine Amphibious Force (III MAF) during his tour as Commanding General.

"It is difficult to express adequately my appreciation to the officers and men of the Station Hospital for the dedicated care they have provided the sick and injured in support of operations of the III MAF. Since the opening of the Hospital in January 1966 hundreds of Medical Department personnel have contributed and it is manifestly impossible to single out individuals for outstanding performance when virtually all have given inspired service. Over ten thousand patients have been cared for since the opening of the Hospital in January 1966. The peak census was reached in May 1967. In spite of this continually increasing responsibility the same high level of dedicated care has been provided.

"It is my desire to personally inform you as Chief of the Bureau of Medicine and Surgery, and as Surgeon General of the United States Navy of the accomplishments of Medical Department personnel under most trying circumstances. I thank God for the great services the Naval Hospital DaNang has rendered the Marines and Navy men of III MAF."

NAVY'S DEEPEST EXPERIMENTAL MEDICAL PRESSURE CHAMBER TO BE AT SUBMARINE MEDICAL CENTER

CAPT C. L. Waite, MC USN, Commanding Officer of the Submarine Medical Center, and Dr. Charles F. Gell, Chief Scientist at the Submarine Medical Research Laboratory, announced that an experimental medical chamber for simulating pressures to 2,000 feet of ocean depth has been delivered and will soon be ready for use.

The chamber, manufactured by the O. G. Kelly Corporation of Boston, Mass., is a five-foot steel sphere with special windows, electrical and compressed gas fittings built to withstand 1,000 pounds pressure per square inch. This chamber will be used for preliminary research for the Navy's Man-in-the-Sea program, the development of new diving tables, and the study of the effect of potentially poisonous gases and elements at very high pressures.

Initially, large animals, such as goats, will be tested, and within the next year, authorization to construct a larger 2,000 foot chamber for testing human volunteers is expected.

When completed, the high pressure experimental testing facilities at the Submarine Medical Center will be among the foremost in the world for physiological and medical experimentation. The new chambers will make the 300 foot chamber used to develop SEALAB I seem obsolete by comparison.

Dr. Gell, Chief Scientist at the Research Laboratory, feels that the studies conducted with this latest chamber will help pave the way for man to eventually be able to dive beyond 1,000 feet into the sea.—Public Affairs Office, U.S. Naval Submarine Medical Center, Groton, Connecticut.

TWO NAVSUPPACT MEN "DOC" FOR VILLAGE OF 72,000

Each evening approximately 150 Vietnamese receive medical aid from two U.S. Navy Hospital Corpsmen in DaNang, Vietnam.

Thac Gian Village is the largest village in DaNang, according to Navy Chief Builder, James N. Spaulding, Leading Petty Officer of NSA's Civic Action Department. The Village is occupied by 72,000 Vietnamese, and at each "sick call," the villagers literally crowd-in to see the "doc."

Aid, ranging from treating minor sores to severe cases of pneumonia, is rendered by Navy Hospital Corpsman First Class, Robert E. Tillack of Minneapolis, Minnesota, and Hospital Corpsman Second Class, Michael L. Kroutil of Yukon, Oklahoma. The services rendered by these men is done during their off-duty hours.

Through the Civic Action Program, Tillack and Kroutil have procured most of the supplies they need to do the job. Other materials needed must be procured on their own. Most of the time, they get them.

At Thac Gian Village, the Corpsmen hold "sick call" for a period of five hours or more each evening.

It was stated by Navy Hospital Corpsman First Class, Donald E. Bailey of San Angelo, Texas that, "If these guys (Tillack and Kroutil) continue in that work, they alone will just about double the amount of patients treated by Med Cap Teams in DaNang." Med Cap Teams are medical teams detailed to render aid for minor illnesses of the Vietnamese.

"They needed help pretty darn bad; we had something to offer," Tillack said, "and they accepted it. We are giving them the best medical attention that we can. Every hour spent in the Village is a well spent hour."

When asked about their job in conjunction with the war efforts, Tillack answered, "I definitely feel that our job in this Village is contributing to the fulfillment of our commitment in Vietnam."

Assistant Civic Action Officer, LT Philip N. Bennett of Baton Rouge, Louisiana said, "It's a job that needed to be done. We are proud as well as thankful for the initiative and the time these men are contributing to get this job done."—By: Seaman Daniel Holmes, U.S. Naval Support Activity, DaNang.



A BANDAGE IN TIME . . . Corpsman Kroutil applies a bandage over the injured eye of a Vietnamese woman.

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